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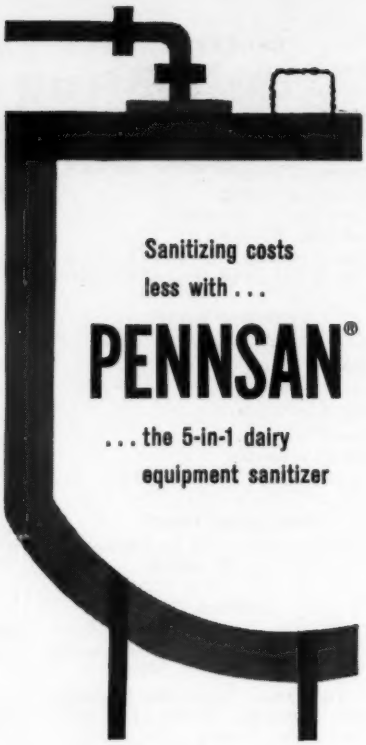

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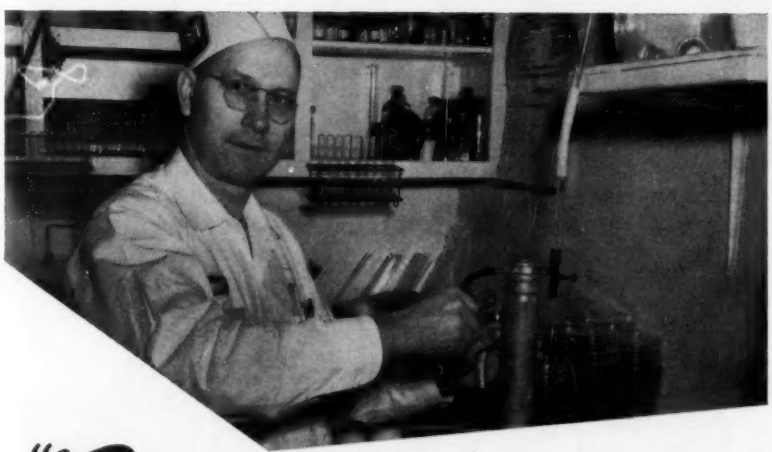

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HOSPITAL SANITATION[1]

Editorial Director, Hospital Management, Chicago, Ill.
CHARLES U. LETOURNEU, M.D.[2]

The outcry about staphyloccal infections in hospitals raises the important question of the basic causes of the increased infection rate in hospitals. The answer is relatively simple. The problem of nosocomial infections in hospitals is one of sanitation rather than some unfortunate phenomenon which God has visited upon us. Hospital sanitation has always been a problem. In the latter portion of the eighteenth century, John Howard, the celebrated prison reformer visited many hospitals and commented at length on their lack of cleanliness. His classical eye witness account of the hospital of St. John of Jerusalem in Malta paints a picture of hospitals at that time. He wrote that, *the wards were all so dirty and offensive as to create the necessity of perfuming them.*

He advocated fresh air, cleanliness, water and washing the walls with lime. He praised clean hospitals and condemned dirty ones. For example, he commented favorably upon the water closets which he found in Guy's Hospital in 1786. The sanitation of the hospital, then as now, depends, to a large extent, upon the medical philosophy of the time. This was the era of *laudable pus* and the stench was a by product of the medical treatment which encouraged the formation of pus. Almost everyone admitted to a hospital could expect to become the victim of nosocomial infection. In modern times, the unfortunate reliance of some physicians upon antibiotics instead of asepsis has created a similar, though less offensive, situation in our hospitals.

It was about 1830 that the theory of *laudable pus* fell into disrepute with a consequent improvement in the quality of the people who served the patients in hospitals. During the era of *laudable pus* only the poorest type people could be found to work in such a foetid atmosphere. With the improvement of the environment in hospitals a better quality of nurse was attracted so that, in 1840, Elizabeth Fry was able to establish a school of nursing for young ladies.

EARLY SANITATION EFFORTS

In 1835 Oliver Wendell Holmes found that patient infection was greatly reduced when he washed his hands in a chloride of lime solution between patients. In 1847 Semmelweiss was able to reduce hospital infections by dipping his hands in a chlorine solution before examining the next patient. About 1850 Florence Nightingale bagan to put into effect the recommendations which John Howard had made some seventy years before and she added a few of her own measures of cleanliness. The celebrated Lord Lister, in 1865, used a five percent solution of carbolic acid on his instruments and used a skin preparation of two and one-half percent carbolic acid on his patients before operation. He later changed to a solution of mercuric cyanide. The German surgeon Von Bergmann used bichloride of mercury in 1882 and this disinfectant remained popular for more than fifty years afterwards.

The smell of carbolic acid became identified with hospitals and created a psychological impression of cleanliness. To this scent was later added iodoform which marked indelibly all who worked in hospitals. These hospital smells were very reassuring but they only masked the dirt just as perfume had done in the days of John Howard. This was the era of antisepsis which gradually gave way to asepsis—the era of cleanliness. Asepsis was mainly due to the influence of the disciples of Florence Nightingale who popularized the fact that clean surfaces do not smell.

At the turn of the century everyone who entered the nursing profession was indoctrinated with the importance of cleanliness. For nearly fifty years, probationers learning to be nurses were handed a bucket and scrub brush and made to clean the floors as a part of their earliest discipline. Nor was this policy confined only to nurses. Some hospitals began the apprenticeship of surgical interns and residents with a tour of floor scrubbing in the operating room and the surgical suite. These experiences left lasting impressions upon surgeons and nurses. Many today deplore the tendency of professional training to abolish these object lessons. It is undeniable that present day physicians and nurses are much less conscious about the need for cleanliness than they were thirty years ago.

SULFONAMIDES AND ANTIBIOTICS

In the period immediately preceding World War II, hospitals were probably the cleanest that they have ever been in history. Cross-infections were held to the minimum. Sterile and aseptic techniques were highly developed. The discovery of sulfonamides and their action on bacteria in 1936 initiated a period of laxity in hospital sanitation which was aggravated by the discovery of antibiotics in 1943. World War II also left hospitals with a personnel shortage and a consequent deterioration in cleanliness. It became

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1. Presented at the 21st Klenzade Educational Seminar, Sun Valley, Idaho, April 3, 1959.

2. Consultant in Hospital Administration and Director, Program in Hospital Administration, Northwestern University, Chicago, Ill.,

fashionable in the immediate post-war period to prevent cross-infections by prophylactic *shots* of antibiotics instead of maintaining a high standard of cleanliness. This practice undoubtedly reduced the payroll but the price of poor sanitation had to be paid sooner or later.

Concurrently with this development was a laxity in pest control occasioned by the discovery of D.D.T. during World War II. About the year 1951, reports began to appear in scientific journals concerning resistance of certain insects to D.D.T. Shortly afterwards certain bacteria were identified as resistant to penicillin. Among these resistant bacteria was the *staphylococcus aureus* soon glamorized as the *golden villain* in a national consumer magazine. The real villain was not the *staphylococcus*. The cause of our present plight is poor sanitation.

HOSPITAL ACQUIRED INFECTIONS

Early in 1957 we summarized a few of the reports of hospital-acquired infections which included not only staphyloccocci but also streptococci, salmonella, coliforms, gas gangrene, tuberculosis, viral hepitatis and other microbes. To these could also be added certain fungus diseases which did not receive much publicity at the time. At this time we advocated a return to a state of biological cleanliness in the hospital. After a lapse of nearly twenty years, it is difficult to pick up old aseptic techniques at the point that we abandoned them. But if we are able to solve this problem, this must be done even if we are obligated to return to the era of the smelly antiseptics. In our report we advocated the appointment of a *Committee on Infection Control* composed of certain key personnel to study the situation in the hospital and to make recommendations for correction of existing defects. This committee was later endorsed by the American Hospital Association and the Joint Commission on Accreditation of Hospitals.

This Committee first of all must inspect the hospital from top to bottom and report honestly and fearlessly the true facts of the situation. Before any cooperation can be obtained, all must admit that there is a situation needing correction. Some authorities recommend that an elaborate system of reporting cross-infections be maintained by the medical staff of the hospital while others prefer to place this responsibility in the hands of the nursing staff. In theory, then, the reports are passed to the Infection Control Committee to investigate the causes. In most instances the committee does a good job of investigation, identifies causes and then makes recommendations to the administration.

INFECTED PATIENT

The first source of cross-infection is, of course, the patient himself. It is now a standard recommendation, by infection control committees, that every patient suffering from an infection such as a boil, an abscess, an infected wound, a sore throat or a dysenteric condition be isolated and handled according to the techniques usually employed for infectious diseases. This calls for elaborate hand washing, gowning, masking and, in some instances, the use of rubber gloves before approaching the patient. Some hospital administrators fear that these drastic measures will increase the payroll of the hospital which is currently at an all time high. Some physicians and nurses, out of practice in such techniques for more than twenty years, regard these measures as extreme. There is resistance to overcome in instituting strict isolation of all infected patients.

PATIENT ENVIRONMENT

The environment of the infectious patient must also be subjected to drastic sanitation procedures. The patient's room should be cleaned as if he had smallpox or tuberculosis before placing another patient in that room. The room itself should be completely and thoroughly washed down with effective chemical substances having a residual bactericidal action. Floors, walls, furniture, cupboards and bathrooms should be thoroughly disinfected. Drapes, mattresses, pillows, screens and all textile materials should likewise be treated and disinfected.

The adverse publicity given to hospitals as a result of articles in national journals has undermined public confidence in our cleanliness to such an extent that it will be difficult to restore the faith of the people in the sterile atmosphere of the hospital. Taking a leaf from the book of some well operated hotels and motels, we must now present the patient with his own sanitized drinking glass, wrapped in its own sealed container, his own seal-wrapped sterilized bedpan, urinal and water carafe with the final psychological touch of the paper tape across the toilet seat. The use of disposable materials such as urinals, paper towels and sputum cups and other disposable containers will further tend to create a favorable impression upon the patient.

PERSONNEL TRAINING

In most hospitals, a complete indoctrination and training of personnel handling patients will have to be undertaken. Personnel handling patients with infections due to staphylococci will soon become carriers of the infection unless they take adequate precautions. Frequent examination of personnel handling infectious patients, throat cultures and strict sanitary discipline must be put into effect. All personnel working in sensitive areas in the hospital such as surgery, maternity and nursery should be obligated to change

clothes completely, to take a shower bath upon entering the hospital and again upon leaving same. Doctor's, nurse's and employees' locker rooms should be thoroughly swabbed down at least once a week with residual bactericides and frequent cultures should be made of these areas. All personnel suffering from any kind of infectious disease should be obliged to report to the employee health service under pain of dismissal whenever they are afflicted by pimples, boils, sore throats or diarrhea. If they are found to be suffering from such infections they should be transferred to a less critical part of the hospital or sent home *without loss of pay.*

ENGINEERING ASPECTS

The engineering aspects of the hospital present a problem which is often insurmountable in old hospitals. Old buildings in a poor state of repair can be kept clean only with the utmost difficulty and expense. The circulation of air must be checked and, in particular, humidifiers in the airconditioning system should be cultured frequently for the presence of bacteria as well as the ducts, vents and screens leading to sensitive areas such as the operating room, delivery room, and infant nursery.

All laundry and refuse chutes should be nailed shut. Garbage disposal may be accomplished by means of sealed plastic bags. These should then be transported on special carts and should be incinerated. Fomites especially need careful treatment. Linens should also be handled by means of carts. Techniques of bringing dirty linen to the laundry and clean linen back from the laundry should be well established. Under no circumstances should the same employee receive dirty linen and issue clean linen nor should the same carriers or containers be used both for clean and dirty linen.

EQUIPMENT CLEANING

Elevators, dumbwaiter and conveyor wells should be cleaned daily to prevent an accumulation of garbage and infected dust which ultimately circulates through the hospital with each change in air pressure and air current. Equipment maintenance must also take into consideration techniques of infection control. Examples of these are oxygen therapy and anesthesia equipment, incubators, autoclaves and laboratory equipment. Techniques of cleaning refrigerator compressors for example, should be worked out between the maintenance department and the infection control committee. The housekeeping department is also responsible for environmental sanitation. Janitors' closets, mops, waste baskets and cleaning processes, for example, should be closely supervised for good sanitation.

The most sensitive areas are the surgical operating room, the delivery room and the infant nursery. The infection control committee must review all the techniques in these areas and lay down certain rules and regulations that must be observed. In the operating room, for example, an automatic clock should be set up over the scrub sinks with a large dial so that all can check the length of time that each person scrubs. Such clocks were standard equipment thirty years ago in many hospitals. They were usually set for a ten minute period.

DISPOSABLES

The use of disposable drapes in the delivery room is another procedure that should be considered by the infection control committee. Policies should be formulated and standing orders written. In the infant nursery the methods of cleaning screens, heating coils, tables, doors and baby scales should be regulated. Sanitation in the formula room should also be regulated. The techniques used by the central sterile service in preparing sterile packs will have to be considered thoroughly. Whether it is better practice to use disposable syringes or reuseables may depend upon safety rather than cost.

There is much work for the committee to do. The sensitive areas of the hospital are only the beginning. The committee should inspect thoroughly every nurses' station and in particular should look into desk drawers, cabinets, and cupboards for clutter and untidiness which may breed disease.

The same principle applies to ordinary office sanitation. All desk drawers, filing cabinets, stockrooms and cupboards should be opened up frequently, cleaned out and thoroughly sanitized with bacteriostatic compounds at least twice a year. Dust from the offices is just as infectious as that from other parts of the hospital.

SPECIAL SERVICE DEPARTMENT

The laboratory and the x-ray departments also should not escape the scrutiny of the committee. Cupboards should be opened up and a strict rule should be enforced against eating snacks, sandwiches and other vermin attractors in the department. Even though the department may be extremely busy, it does not warrant the consumption of food while a technician is working.

The physical therapy department is also a fertile source of contamination if adequate sanitation is not enforced. The water baths and the hot packs can develop slime quickly if not disinfected. The exercise equipment must also be disinfected regularly. In the emergency room, stretchers, wheel chairs, furniture and the entire general area should be swabbed down with disinfectants frequently.

Kitchen sanitation is, of course, of the utmost im-

portance. Regular examination of food handlers is required by law in many places. The cooking and food preparation equipment, such as slicers, mixers and peelers must be sanitized according to standard techniques. But, in addition, the committee must look for such items as dirty dish cloths, and accumulations of old chewing gum under cafeteria tables. Those rarely used closets, cupboards and nooks may harbor almost anything from pieces of half consumed dry toast to umbrellas and galoshes stored for inclement weather. They must be cleaned out regularly.

These foregoing recommendations are but a sample of the problems that must confront every infection control committee in the hospital. In the present state of our hospital sanitation, membership on such a committee would have to be a full time job if the committee is to be effective.

HOSPITAL SANITATION

It is now some two and a half years since we recommended an infection control committee. Experience now indicates that the committee is usually ineffective in making changes in the cleanliness of the hospital because its members have neither the time nor the knowledge to do a thorough job. In order to do its job adequately, the Infection Control Committee must be provided with a full time qualified *sanitarian* to act on its behalf as a staff person. As constituted at preseent, the infection control committee of a hospital is strictly a *do-it-yourself* operation to be undertaken during the spare time of each member of the committee.

It is proposed therefore that an entirely new professional person, to be called a *hospital sanitarian*, be assigned as a full time member of the health team with primary responsibility for the sanitation of the hospital. This person would cut across department lines and have authority to scrutinize, report upon and, in some instances, enforce the regulations of the hospital for the control of infections.

Experience has shown that violations of techniques occur not at the lower levels of personnel but rather among the most highly placed responsible people. Department heads, administrators, directors of nurses, and practicing physicians are sometimes the worst offenders in breaching regulations.

In the beginning, it may be necessary for the hospital sanitarian to be responsible only to the committee. While each member of the committee is knowledgeable in his or her own particular specialty, all are remarkably ignorant of what goes on in other departments. The sanitarian will be expected to fill these gaps and to examine every department from the point of view of sanitation. For example, the housekeeping department rarely penetrates into the autopsy room while the director of nurses knows next to nothing about sanitation in the kitchen.

INSPECTION AND REPORT

Initially, the hospital sanitarian must make a complete sanitary inspection of the hospital and report in writing to the committee. The committee should then identify the most pressing problems in order of priority and assign the sanitarian to deal with these. In many hospitals, there is work enough for at least five years for a competent sanitarian to draw up techniques, procedures, rules and regulations for carrying out proper sanitation. At the end of that time, the sanitarian should have the job of policing the regulations on behalf of the committee, training new personnel in good sanitation and dealing with such emergencies as may arise from time to time.

Until hospitals are able to acquire such people as hospital sanitarians, we will be a long time getting out of the unfortunate predicament in which we now find ourselves. As in the past, the United States Public Health Service has taken the lead in establishing positions for hospital sanitarians in certain of its larger hospitals.

RECRUITMENT

Where can such people be obtained? At the present time, the specialty of hospital sanitarian does not exist. There are sanitarians of various grades, and specialties who are doing an excellent job in the preservation of the public health of the United States. There are several colleges and universities now offering academic training for sanitarians and there is evidence that many sanitarians with sound scientific training would be interested in the challenge of hospital work.

At this particular time, a full time hospital sanitarian of acceptable qualifications would command a salary of between six and eight thousand dollars per annum. Smaller hospitals might be persuaded to band together to obtain the services of a consulting sanitarian. Some commercial corporations do perform sanitation surveys for hospitals but obviously this can only be done on a one time basis and without continuing supervision. Hospitals would do well to consider returning to the principles of public health and recruiting professional sanitarians for service within the four walls of the hospital. The full-time sanitarian may be an answer to the control of nosocomial infections.

SANITATION IN A CITRUS CONCENTRATE PLANT

D. I. Murdock

Minute Maid Corporation
Orlando, Florida

The most unprecedented development ever observed in the food industry is that of frozen concentrated orange juice which was first produced commercially in Florida during the 1945-46 season. The product was quickly accepted by consumers who were attracted by its convenience and by its flavor which closely resembled that of fresh orange juice. The demand accelerated the first season's production of 226,000 gallons to 21,647,000 gallons by 1949-50, and to about 75,000,000 gallons in 1956-57, of which 72,000,000 were produced in Florida. In addition, Florida produces nearly 4,500,000 gallons of various other citrus concentrates annually. There are now 28 concentrate plants in Florida which utilize nearly 60% of the orange crop annually. To do this, the plants must operate 24 hours a day and 6 to 7 days a week during the five peak months of citrus production.

This tremendous increase in volume has created numerous sanitation problems, primarily because these frozen concentrates are a non-sterile food product. Recognition of this fact has led to establishment of superior sanitary standards and the use of the most modern equipment and processes. For example, after leaving the fruit extractors, juice is handled entirely in stainless steel equipment and is not touched by human hands. Equipment is designed for easy cleaning and is readily accessible. The floors of plants are constructed of cement or tile and metal is employed for construction instead of wood wherever practical. In-plant chlorination of water is normal practice as is use of highly chlorinated water for sanitizing after clean-up.

For the benefit of those who have never visited a citrus concentrate plant, the following is a brief description of the processing of frozen orange concentrate. At most plants fruit is received by truck, dumped on to a conveyor system, graded for maturity and soundness, stored in bins, washed, regraded and sanitized prior to entering the extractors. Juice leaving the extractors passes through a series of finishers which removes the seeds and pulp. Product prior to entering the evaporators is pumped to large storage tanks which are either held under atmospheric pressure or vacuum. In the evaporators juice is concentrated to the desired solids content, measured as Brix. It is also flash heated either as it enters the evaporators or early in the process of concentrating to reduce enzyme activity and thus retard separation and gelation. The concentrate then enters the blending tanks where it is mixed with fresh juice to replace some of the volatile constituents which were lost during evaporation. The blended (42° Brix) product is either pumped through Votators where it is slush-frozen, or to cold wall tanks. The chilled or semi-frozen concentrate is then held in holding tanks prior to filling into cans. The finished, canned concentrate is quick-frozen in a blast or alcohol freezer, cased and stored in a cold storage warehouse at 0 to -10°F. until shipped through commercial channels to the market.

Due to the magnitude of the subject, this paper will be restricted to a discussion of the more common sources of bacterial contamination encountered in processing orange concentrate. Also to be discussed are cleaning procedures employed by Minute Maid, and biological methods used to detect microbial growth during processing operation.

Microorganisms Found in Frozen Citrus Products

Fortunately, the pH values of citrus concentrate, which average from 3.4 to 4.0, (*4, 18*), limit the growth of microorganisms to those capable of tolerating this acid medium. Organisms known to grow in single strength juices of these acid foods (not including lemon or lime juice) are lactic acid and acetic acid bacteria, yeasts, and molds. Of this group, organisms belonging to the genera *Lactobacillus* and *Leuconostoc* are of prime concern to bacteriologists. Lactic acid bacteria have been frequently implicated in the production of abnormal flavors and odors in concentrates, among which are those described as being similar to "buttermilk" (*7, 8, 16*). The principal species associated with this type of spoilage are *Lactobacillus brevis* and *plantarum* and *Leuconostoc mesenteroides* and *dextranicum* (*7*). Acetic acid bacteria, yeasts, and molds, on the other hand, generally do not grow rapidly enough to build up large populations under conditions that normally prevail during concentration of the juice.

Coliform bacteria and related types (*e.g. Erwinia*) are frequently present on/or in oranges even before they are harvested (*20, 21*). Furthermore, laboratory tests have demonstrated that coliform organisms sometimes are present in orange juice in spite of rigorous aseptic care in harvest and regardless of the amount of aseptic washing given the fruit before extraction (*1, 5*). Routine tests made in a number of Florida plants have shown a very low incidence of coliform bacteria in orange concentrate (*20, 21*). Analysis of these studies shows a very high percentage

of false positive reactions occur in Florida and California (*20, 21, 22, 23*). *Martinez and Appleman* (*10*) also have encountered false positive coliform reactions caused by yeasts. The unreliability of these standard coliform tests as applied to citrus has been shown by Wolford (*24, 25*) to result from the natural fermentable constituents of orange juice transferred to the test medium with the inoculum.

There are no data to indicate that coliform bacteria actually grow in citrus juices. On the other hand, there is considerable evidence to show that coliform bacteria can retain their viability for extended periods in frozen orange concentrate, but die off rapidly in fresh or reconstituted juices (*5, 6, 19*). It is the opinion of Dack (*5*) and others (*20, 21*) that the coliform organisms are of no public health significance in frozen citrus products. It is also the opinion of Vaughn, *et al.* (*20, 21*) that the coliform index of frozen concentrate is of no value for detecting possible fecal contamination that might contain *Salmonella* species; especially when product has been stored before placement in commercial channels, since *Salmonella* and *Shigella* types cannot survive for sufficiently long periods in the acid environment of citrus juices or concentrates; nor can the spores of *Clostridium parabotulinum*, types A and B, germinate, even though they may be present.

Fruit Handling

As previously stated, fruit received at the plant is dumped on to a conveyor system, graded, stored in bins, regraded, washed and sanitized prior to entering the extractors. The sanitary condition of each unit operation plays an important role in minimizing fruit surface contamination. The brush washer in combination with a chlorinated water rinse is very effective in reducing fruit surface microflora. This piece of equipment, as the name implies, is employed to wash fruit prior to entering the extractors. It is usually accomplished by applying detergent and/or wetting agent to the fruit entering the washer, and rinsing the fruit at the exit end with chlorinated water. The effectiveness of this phase of operation on fruit surface contamination was investigated in one plant (*11*). It was found that rinsing fruit with unchlorinated water resulted in a 79 per cent reduction in fruit surface microflora, while 10 p.p.m. and 20 p.p.m. chlorinated rinse gave a 92 and 98.8 percent reduction respectively. On the basis of this study, water containing 20 to 25 p.p.m. of chlorine is used to sanitize the fruit in our plants.

Fruit after sanitizing may become recontaminated if subsequent fruit handling equipment is not kept in a sanitary condition. This may result from slimy belts, sizers, and elevators. For example, a sample of slime from a canvas flap used to provide a more even distribution of fruit entering a size grader gave a total viable count of 368,000,000 microorganisms per gram. It is apparent this material will readily increase the microbial load of any surfaces it contacts. Recontamination of fruit surfaces may also occur just before fruit enters the extractors if they are not properly cleaned.

Fruit Grading

The soundness of fruit entering the extractors is so important in controlling final product quality that proper grading of fruit cannot be too strongly stressed. If unsound fruit composed of a large percentage of drops, soft deteriorated spots, splits, etc. is permitted to enter the extractors it not only contaminates juice room equipment and evaporators, but may also result in "stale" or "old fruit" flavors in the finished product. For this reason fruit is carefully graded before entering the bins and again before the extractors. In the initial operation unsound fruit received at the plant is sorted out, and fruit damaged in the bins removed by the final graders. In a previous study (*15*) it was found both fruit surfaces and extracted juice from splits and deteriorated fruit were heavily contaminated with microorganisms, as indicated in data presented in Table 1. It is quite obvious from these results that if defective fruit is not removed from the line by final graders it will readily "seed" juice extracted from sound oranges.

TABLE 1 — MICROFLORA ON THE SURFACES AND IN THE EXTRACTED JUICE OF SOUND AND DEFECTIVE FRUIT

Type of Fruit	Contamination on fruit surfaces Total microflora per orange		Contamination of extracted juice Total microflora per ml.	
	Test 1	Test 2	Test 1	Test 2
Sound Fruit		74,000		500
Drops	64,000	855,000	29,000	1,500
Splits	113,700,000	21,400,000	2,800,000	620,000
Deteriorated Fruit	3,250,000	44,200,000	9,200,000	3,100,000

EXTRACTION OF FRUIT AND PREPARATION OF JUICE FOR CONCENTRATE

Up to this point we have discussed the need for microbial control when fruit enters the processing plant. Unless an efficient sanitation program is maintained, microorganisms harbored on fruit surfaces will seed juice extraction and/or handling equipment.

Extractors and Juice Lines

There are two principal types of commercial juice extractors used by the frozen concentrate orange juice industry; namely—Brown (Brown Citrus Machinery

Company) and the F.M.C. In-line (Food Machinery Corporation). Both machines are satisfactory from a sanitation standpoint if cleaned properly.

Juice from the extractors is conveyed by gravity to the finishers either by a 4-inch stainless steel tube or by means of a juice trough. Unless sanitary precautions are adhered to, slime and/or citrus solids will build up on the inner walls of the tube, and covers and sides of the juice trough, resulting in a source of contamination. To minimize microbial build-up from these sources in our plants, extractors, product header lines and troughs are flushed with chlorinated water at 4-hour intervals. Effect of this type of intermittent cleaning will be discussed in another section of this paper.

Dead Ends

A dead end occurs where a product flows into an area without an outlet. Sanitarians are on a constant lookout for dead ends which may be found in any part of the piping system in a plant. A few years ago they were not uncommon in juice troughs and header lines. Juice in these areas, being stagnant, becomes a medium for microbial growth and product coming in contact with it is readily seeded with microorganisms. The potential build-up that may occur from a dead end is shown in Table 2 (*14*). A similar

TABLE 2 — BACTERIAL CONTAMINATION FROM DEAD END IN JUICE TROUGH

Date	Juice from extractor next to dead end (per ml.)	Juice from dead end in juice trough (per ml.)
Jan. 28	2,800	470,000
Feb. 3 (AM)	25,000	51,000
Feb. 3 (PM)	23,000	77,000
Feb. 4	3,000	10,000
Feb. 6	27,000	106,000

area of stagnation also occurs in juice troughs and header lines when extractors farthest away from the finishers are shut down due to inadequate fruit supply. Extractors removed from the line for any length of time should be thoroughly flushed with chlorinated water.

Finishers

A standard screw-type finisher is usually used in removing seeds and pulp from the juice. This process provides one of the major sources of contamination. Generally speaking, a finisher is a difficult piece of equipment to keep in a sanitary condition. It contains areas that are not readily accessible, especially the discharge end of the first finisher and pulp enclosure between the two units in a double finisher installation. It was found, in one plant, that pulp adhering to the walls of the finisher would sour in approximately 6 or 7 hours if not removed during the intermittent cleaning operation. Citrus solids and hesperidin continually build up on finisher screens. To eliminate this source of bacterial build-up, they are changed at least once every 8 hours, or more frequently if required.

Juice Holding Tanks

Juice after leaving the finishers is held in one or more holding vessels either under atmospheric pressure or vacuum prior to entering the evaporators. These tanks may range from a few gallons to several thousand gallons in capacity. Product carried under vacuum usually is deaerated prior to entering the tank.

Holding vessels, especially those where juice is held under atmospheric pressure, require periodic cleaning to prevent them from being a source of contamination. In some installations, not under vacuum, foam readily forms on the surface of the juice. When this occurs, special precautionary measures should be taken to minimize microbial growth. Draining the tank and flushing with chlorinated water may not suffice unless all foam is removed from the vessel in one operation. A sizeable bacterial build-up resulted in evaporator feed juice in one plant (*14*) where this was not done during the intermittent cleaning period, as data in Table 3 indicate.

TABLE 3 — CONTAMINATION OF JUICE IN EVAPORATOR FEED TANK WITH EXCESS FOAM BUILD-UP[a]

Test No.	Juice entering Tank (per ml.)	Product leaving Tank (per ml.)
1	80,000	144,000
2	87,000	816,000
3	63,000	420,000
4	150,000	200,000

[a]Data obtained over a 2-day period.

Deaerated evaporator feed juice may also be a source of contamination when the system is not functioning properly so as to cool the juice (*14*). Table 4 shows bacterial build-up which occurred over a 4-day interval when difficulty was encountered in operating the system. The vacuum tank had a sour odor when examined after a run of approximately 96 hours. Table 5 shows that little or no increase in contamination of deaerated evaporator feed juice occurred during a period when the tanks were working properly (temperature range 49-60°F.) (*14*).

TABLE 4 — CONTAMINATION OF DEAERATED EVAPORATOR FEED JUICE[a]
(Vacuum Tank Not Functioning Properly; Usually Operates at 55°F.)

Date	Juice entering vacuum tank (per ml.)	Product leaving tank (per ml.)	Temp. (°F.) range of juice leaving tank
Jan. 15	11,000	32,000	47 - 70
Jan. 16	25,000	77,000	68 - 72
Jan. 17	21,000	110,000	60 - 68
Jan. 18	24,000	371,000	67

[a]Vacuum Tank not flushed or cleaned during processing period.

TABLE 5 — CONTAMINATION OF DEAERATED EVAPORATOR FEED JUICE DURING PERIOD WHEN VACUUM TANK IS OPERATING PROPERLY[a]

Date	Juice entering vacuum tank (per ml.)	Product leaving tank (per ml.)	Temp. (°F.) range of juice leaving tank
Jan. 19	1,000	2,000	51
Jan. 20	3,700	5,000	57 - 60
Jan. 21	1,000	4,000	56
Jan. 22 (AM)	1,000	3,000	49 - 54
Jan. 22 (PM)	13,000	15,000	

[a]Vacuum tank not flushed or cleaned during processing period.

Centrifuge

The centrifuge, which is usually associated with the dairy industry, is beginning to find some application in the removal of pulp solids from orange juice prior to entering the evaporators. Bacteriological studies made in two plants have shown that the centrifuge can be operated continuously up to 24 hours after cleaning without becoming a serious source of contamination. It was also noted that after the unit has been cleaned, juice leaving the centrifuge for the first 8-12 hours is usually lower in microflora than product entering. The opposite is generally true after longer periods of operation.

Stabilizer

As previously stated, stablizing, the term employed to designate use of heat to treat juice, is usually accomplished by flash heating the product either as it enters the evaporators or early in the process of concentration. Temperatures ranging from 150°F. to 190°F. are employed, with holding times of 2 to 15 seconds followed by rapid cooling within the exchangers or by flashing the juice to the evaporators. Under normal operating conditions this type of heat treatment results in an 80-99% reduction in bacterial population (*12*). It was found (*12*) where a plate heat exchanger is employed to heat the juice that, from time to time, instead of a reduction in bacterial counts after heat treatment an actual increase resulted (Table 6). A further investigation showed that the

TABLE 6 — BACTERIAL COUNTS OF CONCENTRATE BEFORE AND AFTER HEATING SECTION, AND AFTER REGENERATIVE SECTION
(Holding Time 2.5 Seconds at 150°F.)

Test No.	Before entering heat exchanger (per ml.)	Immediately after heating section (per ml.)	After Regenerative section (per ml.)
1	30,000	<10	200
2	117,000	<10	400
3	135,000	<10	30,000
4	135,000	<10	2,000
5	133,000	300	23,000
6	133,000	1,000	32,000
7	131,000	4,000	123,000

regenerative section of the unit was the source of bacterial build-up. The contaminating organism was isolated and identified to resemble closely *Lactobacillus buchneri*. Optimum conditions for growth of the organisms in orange juice were in the Brix range of 12 to 20° at temperatures between 110°F. and 120°F. At 78°F. it grew at a much slower rate, and at 130°F. no growth occurred.

Control of this type of contamination can be accomplished in a number of ways, some of which are: (*a*) eliminate any regenerative or cooling section of the heat exchanger operating in the critical temperature range (approximately 100°-120°F.) and flash juice directly into next stage of evaporation; (*b*) clean stablizer thoroughly every 4 to 6 hours; (*c*) cool juice, after heating, to a temperature *above* the growth range of the organism; and (*d*) stabilize juice above 30° Brix.

Evaporators and Finished Product

The evaporators, which are of various designs, are operated under high vacuum and low temperatures (approximately 65-80°F.) Juice is concentrated to the proper degree Brix, and up to 75% of the water may be removed. It has been our experience that evaporators are not a potential source of contamination, providing they are properly cleaned and have not been on the line for extended periods of time. In our plants they are generally operated between 60 to 80 hours, then shut down and thoroughly cleaned.

Subsequent processing equipment consisting of blending tanks, Votators, and filler bowls are not a source of contamination during operating periods, since concentrate in these units is usually in the tem-

perature range of 25°F. to 30°F. Of interest here, is a brief reference to Minute Maid's exclusive new development which involves use of inert gas to protect juice from air during the entire process. Air has been found to harm flavor of frozen concentrate and shorten its storage life. While not necessarily a function of sanitation, this development is an important step forward in improvement of flavor quality of frozen concentrates.

Finished canned product (42° Brix), due to stabilizing and the high sanitary standards followed by the industry, has a very low level of bacterial contamination. Our orange concentrate, for example, had an average count during 1957-58 season of less than 10,000 microorganisms per ml. (see Table 7).

TABLE 7 — FINISHED PRODUCT COUNTS FOR ORANGE CONCENTRATE (42° BRIX) FOR 1957-58 SEASON

Month	Plant No. 1 Av. per ml.[a]	Plant No. 2 Av. per ml.[a]
December	700	300
January	1,000	2,900
February	800	1,500
April	1,200	2,400
May	5,200	3,200
Average for Season	1,600	2,100
Number of Samples Examined	307	381

[a]All counts are the number of microorganisms per ml. of reconstituted juice using orange serum agar as the plating medium at 30°C. for 48 hours.

CLEANING AND SANITIZING

If good quality is to be maintained in the production of a highly perishable product such as frozen orange concentrate, it is essential that it be protected from contamination by microorganisms. Microbial growth, if not controlled by an effective cleaning program, may result in yeasty, fermented, and buttermilk flavors in the finished product. To minimize contamination from microorganisms, the frozen citrus concentrate industry has established a highly efficient sanitation program (*2*). The approach to the problem may vary from plant to plant but the basic fundamental sanitary principles are more or less followed throughout the industry.

Minute Maid, for example, has established a definite cleaning program which may be broken down into component parts:

1. Continuous cleaning which is necessary to maintain good appearance.

2. Intermittent type cleaning while plant is in operation, or cleaning parts of the plant temporarily taken out of production for long enough periods to clean them properly.

3. General clean-up which occurs when the plant is completely shut down.

The necessary tools have also been provided to accomplish the clean-up in a minimum of time with a minimum of effort. High-pressure cleaning systems have been installed in our plants. The use of jet detergent guns in conjunction with this system permits the cleaning of inaccessible areas more quickly and thoroughly than is possible with other available equipment (*13*). Water hoses have been equipped with nozzles designed to produce sprays for general washing and flushing purposes. Detergent hoses are also available for cleaning the equipment. In-place cleaning systems (C. I. P.),which greatly improve the efficiency of cleaning, have been installed in some of our evaporators. In the citrus concentrate industry there are two basic methods used to clean the evaporators (*17*). In our installations the flooding principle is used for cleaning; that is, the surface is flooded with solution under low pressure. The other type depends upon a rotary sprayer which applies detergent solution to the surface being cleaned. Both methods are effective cleaning tools. The type selected depends upon evaporator design and individual preference.

After each clean-up the entire plant is inspected to insure the equipment is in proper sanitary condition. Prior to start of operations all processing equipment is sanitized by circulating chlorinated water, having a minimum concentration of 25 p.p.m., for at least 15 minutes before rinsing with clear water.

Great care is taken in the selection of detergents for the specific cleaning job involved; *i.e.*, mild alkaline detergents for use in hose, and for equipment subject to corrosion by highly alkaline materials, and highly alkaline detergents or caustic solutions for cleaning evaporators, and for circulating in pipelines which are not dismantled during cleaning. New cleaning agents are also continually being tested throughout the processing season. For example, this season we are using, for the first time, a chelated-type caustic which is proving very effective for cleaning the evaporators.

During processing operations chlorinated water flushes are used at periodic intervals to control microbial contamination in juice extraction equipment, header lines, or juice troughs, finishers, fresh juice tanks, etc. This intermittent type of cleaning, which is believed generally employed by the industry, consists of back-flushing this equipment every 4 hours with chlorinated water of approximately 25 p.p.m. from the plant surface water supply. Chlorinated water flushing is a very effective means of controlling bacterial contamination. In one study, where samp-

les of juice were plated prior to and just after this type of cleaning, a reduction in total counts ranging from 35-62% was obtained (*13*).

DETECTION OF CONTAMINATION BY LABORATORY METHODS

Data have been presented to show several specific sources of contamination. The effect of a routine sanitizing program to control bacterial activity has been discussed. However, during a processing run a bacterial build-up may occur due to poor fruit, undetected source of microbial growth, laxity in cleaning, or a combination of factors which may result in seeding the plant and ultimately causing spoilage if not immediately detected.

Diacetyl and Microscopic Tests

Diacetyl and microscopic tests, which require less than an hour to perform, have been developed as a rapid procedure for the detection of microbial activity in processing orange or grapefruit concentrate (*3, 9, 14*). The diacetyl test is a colormetric method for the detection of diacetyl, and acetylmethylcarbinol, end product of bacterial growth produced in orange juice principally by organisms belonging to the genera *Lactobacillus* and *Leuconostoc*.

The microscopic method (direct count) requires the examination of a stained film of dried juice under a high-powered oil immersion objective. This procedure shows total microflora in a sample examined. In our plants the microscopic method is used for evaporator feed juice, and diacetyl procedure is employed for concentrate and cutback juice. Finished product is not routinely analyzed. These tests are made during processing operation every 4 hours. A steady increase in microscopic count or diacetyl concentration indicates a bacterial build-up. When this occurs an inspection of the plant is made and the source of contamination eliminated as soon as possible.

Plate Counts

Plate counts, the method used by the dairy industry to determine the total number of viable organisms in a product is also employed by the concentrate processors. The plates are counted after 48 hours of incubation at 30°C. on orange serum agar (*pH 5.4*). In our plants samples of juice from various processing operations are plated. These tests, usually referred to by the citrus industry as "line checks," are made just before the plant is shut down for cleaning and again shortly after it is placed in operation. The finished product, on the other hand, is plated every third hour of production.

By following the biological control methods discussed, we have been able to detect microbial build-up in our processing operations, sources of contamination, and determine the efficiency of each clean-up. These procedures have also been highly successful in preventing spoilage of our product.

SUMMARY

Lactic acid bacteria constitute the most important index of processing sanitation in the production of high quality frozen citrus products. Coliform bacteria are indicative of no apparent public health hazard in frozen citrus concentrates, partially concentrated, or single strength citrus juices.

The brush washer and chlorinated water rinses effectively reduce fruit surface contamination. The effectiveness of these sanitizing operations is minimized, however, if subsequent fruit handling equipment is not kept in a sanitary condition. Slimy fruit sizers and conveyor belts, especially those in the juice room, are all contributing factors.

Defective fruit not removed in the final grading operation is heavily contaminated with microorganisms, both externally and internally. An efficient fruit grading system is essential to prevent seeding juice extracted from sound oranges.

Information is presented to show that extractors, juice lines, finishers, and juice holding tanks can be potential sources of contamination if not kept in a sanitary condition. Evaporators, blend tanks and filler bowls are not a potential source of bacterial build-up providing this equipment is properly cleaned and not operated for extended periods.

Proper tools are necessary to maintain an efficient sanitation program which includes both cleaning and sanitizing operations.

Data are presented to show that direct microscopic examination and diacetyl tests, on the product in process, are very important tools in detecting microbial activity during periods of trouble. Total viable count is also an important instrument in the over-all biological control program.

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LITERATURE CITED

1. Beisel, C. G., and Troy, V. S. The Vaughn-Levine boric acid medium as a screening presumptive test in the examination of frozen concentrated orange juice. *Fruit Products, J.*, **28**: 356. 1949.

2. Brokaw, C. H. The role of sanitation in quality control of frozen citrus concentrates. *Food Technol.*, **6**: 344. 1952.

3. Byer, E. M. Visual detection of either diacetyl or acetylmethylcarbinol in frozen concentrated orange juice. *Food Technol.*, **8**: 173. 1954.

4. Cameron, E. J., and Esty, J., R. Comments on the microbiology of spoilage in canned foods. *Food Research*, **5**: 549-557. 1940.

5. Dack, G. M. Significance of enteric bacilli in food. *Am. J. Pub. Health,* 45: 1151. 1955.

6. Hahn, S. S., and Appleman, M. D. Microbiology of frozen orange concentrate. I. Survival of enteric organisms in frozen orange concentrate. *Food Technol.,* **6**: 156. 1952.

7. Hays, G. L. The isolation, cultivation, and identification of organisms which have caused spoilage in frozen concentrated orange juice. *Proc. Fla. State Hort. Soc.* 1951.

8. Hays, G. L., and Reister, D. W. The control of "off-odor" spoilage in frozen concentrated orange juice. *Food Technol.,* **7**: 383. 1952.

9. Hill, E. C., Wenzel, F. W., and Barreto, A. Colormetric method for detection of microbiological spoilage in citrus juices. *Food Technol.,* **8**: 168. 1954.

10. Martinez, N. B., and Appleman, M. D. Certain inaccuracies in the determination of coliforms in frozen orange juice. *Food Technol.,* **3**: 392. 1949.

11. Murdock, D. I., and Brokaw, C. H. Sanitary control in processing citrus concentrates and detection of microbial growth. I. Some specific sources of contamination from fruit bins to extractors. *Food Technol.,* **12**: 573. 1958.

12. Murdock, D. I., Brokaw, C. H., and Allen, W. E. Plate type heat exchanger as a source of bacterial contamination in processing frozen concentrated orange juice. *Food Technol.,* **9**: 187. 1955.

13. Murdock, D. I., and Brokaw, C. H. An effective high pressure cleaning system for citrus concentrating plants. *Proc. Fla. State Hort. Soc.,* 1956.

14. Murdock, D. I., and Brokaw, C. H. Some specific sources of contamination in processing frozen concentrated orange juice. II. Extraction of fruit and preparation of juice for concentrate. *Proc. Fla. State Hort. Soc.,* 238. 1957.

15. Murdock, D. I., Folinazzo, J. F., and Brokaw, C. H. Some observations of gum-forming organisms found on fruit surfaces. *Proc. Fla. State Hort. Soc.,* 278. 1953.

16. Murdock, D. I., Troy, V. S., and Folinazzo, J. F. Development of off-flavor in 20° Brix orange concentrate inoculated with certain strains of lactobacilli and leuconostoc. *Food Technol.,* **6**: 127. 1952.

17. Murdock, D. I., In-place cleaning of concentrate plant equipment with special emphasis on extractors and evaporators. *Proc. 4th Annual Citrus Engineering Conference.* 1958.

18. Pilcher, R. W. *The canned food reference manual,* 3rd ed. 1947. American Can Co., New York, N. Y.

19. Troy, V. S. Coliforms in citrus products. *Report to Florida Canners Association, Winter Haven, Florida,* Sept., 1954. (unpublished).

20. Vaughn, R. H., and Murdock, D. I. Sanitary significance of microorganisms in frozen citrus products. *Am. J. Pub. Health,* **46**: 886. 1956.

21. Vaughn, R. H., Murdock, D. I., and Brokaw, C. H. Microorganisms of significance in frozen citrus products. *Food Technol.,* **6**: 92. 1957.

22. Wolford, E. R. Bacteriological studies on frozen orange juice stored at -10°F. *Food Technol.,* **4**: 241. 1950.

23. Wolford, E. R. Comparison of boric acid and lactose broth for isolation of *Escherichia coli* from citrus products. *Applied Microbiol.,* **2**: 223. 1954.

24. Wolford, E. R. Significance of the presumptive coliform test as applied to orange juice. *Applied Microbiol.,* **3**: 353. 1955.

25. Wolford, E. R. Certain aspects of the microbiology of frozen concentrated orange juice. *Am. J. Pub. Health,* **46**: 709. 1956.

RECIRCULATION–SPRAY VERSUS MANUAL CLEANING OF MILK STORAGE TANKS

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Recirculation-spray cleaning of bulk raw milk holding tanks, and other dairy equipment that may be essentially enclosed during cleaning, has been accomplished with apparent satisfaction in many instances, as determined by visual observation of results. Harper and Seiberling (1), noting that uniform results were not obtained with portable sprays because of differences in tank size, found that permanently installed spray assemblies, tailored to provide adequate coverage, cleaned tanks more effectively by recirculation than by hand cleaning. Their results were determined through bacteriological evaluation, using swab counts on 40-sq. in. areas, as recommended by Standard Methods (2) for large surfaces.

This study was made in order to measure recirculation-spray and manual cleaning of a range of areas in tanks using a chlorinated detergent, typical of several commercially available products, in addition to periodic application of acid detergent. A newly designed "Teardrop" spray bulb was used.

Procedure

Three 2,000-gallon rectangular tanks were cleaned following storage of "grade A" raw milk. Milk was held in tanks approximately 24 hours before emptying and washing. Two of the tanks were equipped with a spray bulb located permanently at the top of the tanks and equi-distant from the corners. The bulbs were of special design to provide a spray of cleaning solution to all areas of the tank. The rinse and washing solutions were circulated by a 5-H.P. centrifugal pump, delivering 60 gpm at 40 psi.

The manual cleaning prescribed consisted of (a) rinsing with warm water until the effluent was clear; (b) scrubbing with a long-handled brush from a 3-gallon pailful of washing solution containing 2.25 oz. of the chlorinated detergent, equal to 0.59% concentration; (c) the tank was rinsed with tempered water for a full 3-minute period using a hand spray nozzle; and (d) after each fifth cleaning with the chlorinated detergent, an acid milkstone treatment was applied over the entire inner area.

Recirculation-spray cleaning consisted of (a) rinsing with 50 gallons of 80°F. water sprayed into the tanks in three equal intervals, allowing drainage between each. A second 50-gallon quantity of 80°F. water was sprayed at one time into the tanks and drained. (b) Recirculation washing used 25 gallons of 0.5% chlorinated detergent solution at 140° or 160° F., as indicated by Table 1. Washing was continuous over a 15-minute period. (c) Tanks were rinsed by the same procedure as pre-rinsing. (d) Acid solution for removing milkstone was applied after each fifth washing with the chlorinated detergent solution. A 25-gallon solution of 0.5% organic acid detergent was recirculated for 10 minutes at 140°F., followed by rinsing with clear water.

The level guage tube was connected with the cleaning system and was washed on the inside by recirculation at the same time the tank lining was cleaned by spraying.

The areas selected for examination by swab counts were distributed so as to determine cleaning effectiveness throughout the tanks (Figure 1). Standard Methods (2) procedures were used with 8-sq. in. areas being swabbed within one hour after washing and prior to sanitizing.

Results

The data are presented in Table 1. Thirteen manual washing trials yielded a logarithmic average swab count of 27 bacteria per area. The average number of organisms per area was fairly uniform, with 70% of the areas having average counts ranging from 13 to 14, inclusive. The average counts of 6 and 10 cleaning trials after recirculation washing at 140°F. were 6.3 and 7.0, respectively. When the temperature of the washing solution was increased to 160°F., the over-all cleaning effectiveness, as measured by swab counts, was improved as shown by 6 trials averaging 5.5 organisms per area and 4 trials averaging 4.5 organisms per area.

Determination of the cleanability of the spray unit bulb was of special interest. Results in Table 1 showed that the collar over the spray bulb, the area around the collar and of the roof close to the bulb yielded low swab counts, practically equal to those in other nearby sections. As a whole, the upper and side areas of the tanks cleaned by recirculation had the lowest swab counts. Slightly higher counts resulted from corner areas and air vent collars than from areas that were sprayed more directly by the cleaning solution.

Visual observation and bacteria counts of swabbed surface indicated that the floor of the tanks and the areas below the cleaning solution level were most dif-

TABLE 1. LOGARITHMIC AVERAGE NUMBER OF ORGANISMS PER EIGHT SQUARE INCHES FROM VARIOUS AREAS IN MILK STORAGE TANKS AFTER WASHING

	Manual	Recirculation			
	Temperature of detergent solution				
	110°F.	140°F.		160°F.	
	1	2	3	2	3
	Number of trials				
	13	6	10	6	4
	Area* swabbed				
a		4.6	9.9	3.3	2.3
b		4.8	2.1	2.6	8.1
c		1.6	3.4	1.4	1.1
d	13	2.2	7.8	3.7	2.0
e	5	6.8	3.9	13.0	8.8
e	8	2.9	3.3	1.6	1.4
f	164	2.6	3.7	7.8	1.4
f	14	7.2	8.1	4.9	6.1
g	13	3.8	5.6	7.4	13.0
h	14	13.0	14.0	4.6	2.1
i	14	13.0	13.0	9.0	3.4
j	14	14.0	14.0	9.2	6.3
k	13	3.1	2.7	2.9	3.0
Average	26	6.3	7.0	5.5	4.5

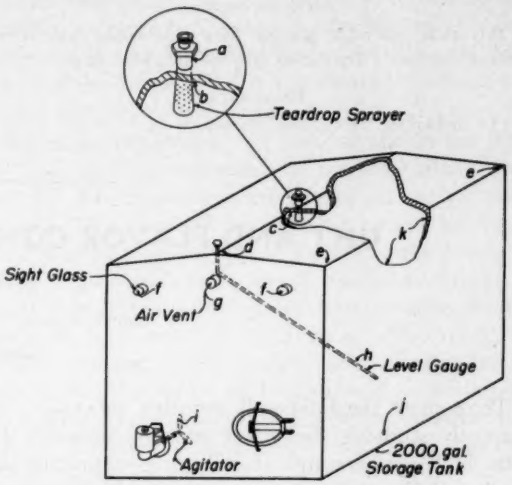
*Location of areas listed alphabetically in Figure 1
a = Collar over spray unit
b = Area just outside collar
c = Point of roof closet to spray bulb
d = Point of roof close to end of tank
e = Two corners ceiling area
f = Two sight glass sleeves
g = Air vent collar
h = King guage pipe below milk level
i = Back side of agitator blades
j = Floor of tank
k = Side of tank where best cleaning should be expected

ficult to clean effectively with 140°F. solution recirculation. The floor, being covered with washing solution, did not receive the benefit of spray scrubbing as did other exposed areas.

With 160°F. washing solution, the floor area of the tanks yielded significantly lower swab counts than 140°F. solution. Superior cleanliness, determined by visual inspection (absence of spotting), was obtained with recirculation cleaning over manual cleaning and was improved when 160°F. solution was used.

DISCUSSION

Experience with cleaning operations and results secured showed that the areas most difficult to clean were the floor, the vents, and the bottom-side of the agitator blades. The floor was believed to receive little physical cleaning action because there was no flow across its surface. The cleaning operator found that a series of short blasts with the pump, during rinsing, increased the washing effect. Also agitator blades should be in operation intermittently in order to clean all surfaces.



LOCATION OF SWABBED AREAS
Fig. I

All tanks that were cleaned yielded bacterial counts considerably lower than the Standard Methods (2) tolerance of 100 organisms per 8-sq. in. In the manually cleaned tanks 21% of the individually swabbed areas, had more than 100 colonies per swab; 4 swabs produced colonies too numerous to count. Only 4% of the recirculation washings showed counts in excess of 100 per swabbed area and none were too numerous to count.

Acid treatment was not planned originally but was included as part of the cleaning procedure after several washings, using the chlorinated detergent solution only, left a noticeable deposit on the stainless steel. The hardness of the water used, 320-360 ppm was believed responsible for mineral deposition. The acid treatment, used after each fifth washing with both manual and recirculation washing, kept the tanks free of visible film.

The recirculation cleaning operation required more water, steam, and washing powder; but the cleaning job, measured by swab count and visual inspection, was superior to manual cleaning.

SUMMARY AND CONCLUSION

The study showed that recirculation cleaning of bulk milk holding tanks, using the specially designed "Teardrop" spray bulb, was more effective than manual washing. This conclusion was based on measurement of swab counts from thirteen similarly located areas in each of three tanks. A chlorinated detergent was used as the cleansing agent for both washing systems. After each five washings with chlorinated detergent solution, the tanks were washed with acid detergent.

ACKNOWLEDGMENT

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REFERENCE

(1) Seiberling, D. A., and Harper, W. J. 1957. A report on the evaluation of ball-spray cleaning of storage tanks and pickup tankers. Milk Prod. Jour. **48** (3): 17.

(2) American Public Health Association 1953. Standard methods for the examination of dairy products, 10th ed. New York.

UHT AND FLAVOR CONTROL PROCESSING OF MILK[1]

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Throughout the fluid milk industry, processors are currently studying the effect and the necessity for ultra high temperatures (UHT) in pasteurizing and the use of Flavor Control equipment with relation to their Grade A bottled milk market. Undoubtedly, the installation of machinery to accomplish either or both of the above by a competitor will result in any plant giving serious consideration to the purchase of similar equipment.

It, therefore, behooves milk sanitarians, laboratory technicians, pasteurizer operators, as well as dairy machinery suppliers to develop an understanding of UHT and flavor control equipment and what it will accomplish for the industry.

The two should be considered together, for as research and field experience have shown, optimum flavor control can not exist without steam treatment, and with steam treatment UHT is available.

To properly understand a process and the equipment used, it is necessary to know why it was developed in the first place. Necessity, being the mother of invention, has again played its part.

Beginning at the source, it is the job of the Grade A dairy farmer to produce, in as sanitary a manner as possible, milk that has good flavor and low bacteria count. It must be cooled and maintained cold until picked up for delivery to the plant.

Good flavor is the one factor over which the Grade A producer has only limited control. Naturally, it is dependent to a great degree on the cows diet. In the past, its control has been based on pasture selection and feeding schedule. This is most difficult, for the diffusion rates of the numerous feed and weed flavoring substances and their retention in milk vary so widely that effective preventative feeding and milking schedules are almost impossible to work out for the entire year. Furthermore, the milking cow is often enticed by the most noxious things, even when she is knee-deep in excellent pasture.

Unless the processor can standardize the flavor, his product will appeal to the consumer at times and repel at other times the taste acceptance of his customers. Milk is but one of many products available to the public. In competition, millions of dollars are invested in the soft drink industry, coffee, tea, etc. These people are leaving no stone unturned to improve and standardize the flavor of their product to attract the buyer.

The chosen task of the processor is to accept farm produced milk in sufficient quantities to fill the demands of his customers; to process it in such a manner as to result in its retaining a high quality under present marketing methods until consumed; and to be attractive enough to compete for the consumers' money. Under present processing methods, milk is still a highly perishable product.

The population trend to the suburbs, along with the rapid development of supermarkets, has resulted in a great many families resorting to once a week buying. Centralization of milk processing plants leading to expanded marketing areas results in greater hauling distances. All in all, a great deal more time is elapsing between production, processing, and consumption than was the case a few years ago.

Therefore, the processor must accomplish the two things for which UHT and flavor control equipment was developed. To understand the net result to the milk itself, we must study the published results of many researchers from all parts of the country.

In solving the problems, we cannot create greater ones by changing the product so as to create a resistance from the ultimate milk consumer. That is, UHT must be so controlled as to not develop an objectionable cooked or carmelized flavor. It has been determined that less cooked flavor will develop at 160°F. for 15 seconds than at 145°F. for 30 minutes (3,8). This indicates that cooked flavor is more a function

[1]Presented at the Annual Meeting of the Kansas Association of Milk Sanitarians and Kansas Society of Public Health Sanitarians November 6, 1958, at Kansas State College, Manhattan, Kansas.

of the time above a certain temperature rather than the maximum temperature used.

Hunziker (7) maintained that in the case of momentary (flash) heating, the undesirable carmelized taste does not appear to a marked degree until the boiling point is reached. Heat effect is cumulative and includes heat up time, holding time at top temperature, as well as the cooling time.

Long before ultra high temperatures were considered for fluid milk, quick time, high temperature pasteurization was under experimentation (5). It was definitely determined that less cooked flavor was developed and better bacterial destruction obtained at 175°F. where the elapsed time was only six seconds total during heating above and cooling back to 140°F. than the vat pasteurization at 144°F. for 30 minutes. Recently, some researchers have stated that excessive carmelized flavor was not developed with elapsed times of ten seconds and maximum temperatures of 240°F. The value of reaching for these higher temperatures is apparent when the following facts are noted.

With all the advantages of HTST as we now know it, higher counts have often occurred when compared to vat pasteurization. While less trouble is encountered with thermophiles, more is experienced with thermodurics (4). With the advent of UHT, we have learned that nearly all of thermoduric and thermophilic bacteria are killed.

Also, pasteurization, besides killing bacteria, has a definite value in enhancing keeping quality (5, 12). Milk has a definite tendency to become rancid with age. Rancidity is due to the presence of the enzyme lipase. Higher temperatures will inactivate this enzyme and reduce this cause of product spoilage increasing shelf life accordingly.

High heat treatment also inactivates oxidases and tends to produce some anti-oxidizing substances, thus UHT will more effectively give greater protection against oxidized flavors (11). The metallic element, copper, is involved, and it serves as a catalyst for oxidation reactions, that is, it speeds up oxidation without being used up in the reaction. The pro-oxident activity of naturally occurring or contaminant copper is always present in unheated milk and is increased as milk is heated to about 155°F. Above this, the pro-oxident properties decrease. Effective locking in or holding cannot be achieved below the boiling point.

Other than pasture selection, feeding time control by the farmer, and platform rejection of excessively bad tasting milk, little was done in the Grade A milk industry up to approximately 10 years ago, other than lifting a vat lid when the milk was hot, allowing the vapors to escape in order to improve bottled milk flavor.

From the condensed milk industry, it was found that the vacuum pan gave considerable relief. Experiments included blowing hot air into the pan, and injecting live steam (7). It was found that steam injection was the most efficient.

Successful equipment has been in use in the butter industry using this principle for some time. Patents for deodorizing equipment are on file as early as 1935 (9). Some of the same equipment has been tried with varying degrees of success in the Grade A field. Side results from rough treatment, however, resulted in further searches for equipment to do the same job in a more gentle fashion. The need for such equipment has been very intense in order to standardize the flavor of bottled milk. Consumers are more critical than ever and milk consumption decreases in almost a direct proportion to the intensity of off flavor present.

As to the incidence of this problem in the market milk supply, the fact is that 44% of all the milk samples used in Collegiate Dairy Products Judging Contests from 1946 to 1954 contained defects listed as feed or weed (9). This gives us the reason for the rapid development of flavor control equipment. Pasture control has not been able to cope with the problem, and it is also true that some of the feed flavors come from the most economical feeds. Another survey revealed off flavors due to feeds in 75% of the samples of pasteurized milk collected from eight cities (2).

The principles learned in the condensed milk and buttermaking industry can be adapted to fluid milk processing, and several machinery manufacturers are now offering equipment designed to help the processor.

Some of these systems employ vacuum only, others employ steam treatment followed by vaporization. Some utilize a single vacuum cylinder, locating it downstream from the raw side of the regenerator, others are downstream from the flow diversion valve. Two cylinders have been used, locating one downstream from the raw regenerator, the other downstream from the flow diversion valve. Another system, uses two cylinders, both downstream from the flow diversion valve. The No. 1 cylinder is used as a stream treatment cylinder and the No. 2 cylinder as a vaporizing cylinder. There is little wonder at some of the confusion existing in the minds of processors as to methods and equipment to employ. Naturally, with these various systems offered, an installed cost differential is anticipated as some of them include a great deal more equipment than others.

Research by many different investigators has led to the following general conclusions. Many of the flavoring substances are volatile at temperatures under 200°F. and can be distilled from milk (9). Some

are soluble in fat, some are soluble in the skimmilk; and others are made up of several components, some soluble in water, others in fat. Then there are the flavoring chemicals which are almost insoluble and some are non-volatile. It has been shown that volatile flavoring substances and those which are soluble can be removed by vaporization, and those which are more or less insoluble require more thorough treatment such as steam distillation which both washes and vaporizes.

It has been established by research and by observation of commercial installations that more complete removal of feed flavors and a more uniform product results when steam is used with the vacuum treatment than when vacuum is used alone. This was confirmed by Dr. William Roberts (*10*) of the University of North Carolina. He reported to the Milk Industry Foundation meeting in 1956, as follows: "All the machines reduced the intensity of feed flavor present in milk. The improvement in the flavor scores was related to the intensity of steam treatment. As the amount of steam treatment increased, the amount of off flavor removed increased. Vacuum treatment alone does not appear to remove the quantity of feed flavor desired by the Dairy Plants."

Dr. W. L. Dunkley (*1*), of California, reported at the Milk Industry Foundation meeting in San Francisco as follows: "The deodorizing treatment is largely a steam distillation process. Its effectiveness in removing tainting substances depends on such factors as volume of steam used, concentration, solubility, and volatility of the substances in the fat and aqueous phases of the milk as well as between the milk and the vapor surrounding the milk film or droplets." He also said, "Undoubtedly, any deordorizing treatment will effect some improvement in most milks with feed flavor."

Here are two separate and distinct problems; first, the need for higher temperature of short duration to provide greater killing power, reduce oxidation, and retard rancidity – the net reason to obtain longer shelf life and a high quality product. This must be accomplished in such a way to keep cooked flavor to a minimum. Second, by steam washing and distillation under vacuum it is hoped to standardize the flavor, eliminating, in so far as possible, the feed and weed flavors commonly encountered.

The most modern UHT and flavor control devices must accomplish these two objectives in a single system and make it possible to install it as an accessory to any HTST unit. In fact, the opportunity of UHT just ahead of a vacuum vessel where instant vaporization and flashing will take place can accomplish the requirements of both. The high temperature time phase can be limited by the distance the infuser or injector is located ahead of the vacuum vessel. Whether the time required as per Dr. Dunkley's statement is available for diffusion and the establishment of the equilibrium between the fat and aqueous phases, as well as between the milk and the vapor surrounding the milk film or droplets, will be determined undoubtedly by commercial installations and further research.

It is generally understood that Ultra-High Temperature (UHT) pasteurization has as its lower limit 194°F. for one second of holding time. There is no set upper limit, but UHT ranges up to the sterilization point.

The processing problems to be solved by adequate equipment have to do with heating, cooling, and vacuum treatment. Heating may be accomplished by usage of heat exchange surface as exemplified by plate equipment or the relatively new jacketed tube types. These are particularly designed to obtain higher temperatures than practical in conventional plate equipment through the use of special heat exchange surfaces and using steam as a heating medium. Then, of course, there remains direct steam injection into the milk flow. This may well prove the most widely accepted method for various reasons, such as economy of installation, and the previously mentioned requirement of steam washing and distillation to effect ultimate flavor control. A remaining reason, and just as important, is the requirement that the product be neither diluted or concentrated. By injecting steam into the milk to raise its temperature, then removing it in a vacuum vessel to effect the removal of off flavors, the exact composition of milk can be maintained with proper automatic controls. The USPHS requires that milk shall not be diluted. Reasonable concentration, however, is not a Public Health problem, but concentration is very important economically to the processor. The cost of necessary controls to prevent concentration as well as dilution is returned very quickly in product saved.

Actual control of concentration and dilution can be attained through the installation of the Taylor Instrument Company Ratio Controller. It will maintain a set temperature differential between milk entering the equipment and leaving it. This temperature differential means that the heat added through steam injection is exactly equal to the heat removed in the vacuum cylinder corrected for whatever heat is lost through radiation from the surfaces of the equipment itself.

The thermodynamic principle making this type of control possible is comparatively simple. The heat added by the steam results in a milk temperature increase. Upon flashing in the vacuum vessel, vaporization occurs, removing enough latent heat to cause a lowering of the milk temperature. By controlling the vacuum level, the temperature of vaporization and

latent heat of vaporization is controlled. With a steady flow of milk, a thermodynamic balance (removing as much vapor as added) is evidenced when the milk temperature loss in the vaporizing vessel just equals the temperature gain from the steam treatment. An additional correction is made for radiation losses.

Control is maintained through the Ratio Controller. By means of sensing elements, it lessens the vacuum when the milk temperature is too low (thus raising the temperature of the product leaving) to prevent concentration. On the other hand, if the temperature is too high, indicating that dilution is occurring, the instrument, which is wired into the Flow Diversion Valve circuit, causes the milk to be diverted. When set (correct) temperatures and vacuum levels are reestablished, the flow diversion valve moves to the forward flow position automatically. Proper operation is continuous and automatic.

In attempting to describe equipment now in use, I will confine myself to that manufactured by The Creamery Package Mfg. Company, as I am more familiar with it. Much of the following is applicable to equipment of other manufacturers. Different systems and models are available to satisfy the varying needs of the industry. These include equipment ranging from vacuum treatment only to steam-vacuum treatment apparatus, and in sizes from that required by the small processor to capacities of 50,000 lbs. of milk per hour.

In general, these units are installed in a standard HTST unit downstream from the heater section and Flow Diversion Valve and ahead of the pasteurized regenerator section down. We recommend that homogenization follow the vacuum treatment in order to assure optimum stability of the fat emulsion.

The product flow when using our system with steam treatment is from the flow diversion valve through a vacuum breaker (to prevent the possibility of pulling a vacuum on the holding tube through the flow diversion valve and lessening the holding time during diverted flow) and to the steam infuser or the atomizing cylinder, as the case may be.

The steam is introduced in such a manner as to result in intimate intermingling of the vapor and milk droplets to obtain the maximum effect of steam treatment without damaging the product. The maximum temperature is attained and maintained for only the brief period necessary for the milk to flow through a special designed pressure control valve into the second or vaporizing cylinder. This interconnecting line between the first vessel and the pressure control valve constitutes a holder at the maximum temperature for which the holding time can be calculated. At the pressure differential valve, the pressure is instantly reduced to the controlled vacuum and flashing or vaporization takes place with the resultant cooling.

The time of vaporization is a function of the size of the second vessel and the quantity of product flowing. Adequate volume must be allowed under this vacuum treatment for the more stubborn flavors to be removed. The milk enters the vaporizing cylinder through tangential opening near the top and swirls around the sides as it drops to the bottom. The vapors and non condensibles are removed from the top of the cylinder through the condenser. This can be either a standard plate type unit installed as a section of the HTST press itself, or a side arm condenser. The milk is removed from the vaporizing cylinder by a centrifugal pump and moved downstream to the homogenizer or the pasteurized regenerator inlet, as the case may be.

There are several factors in the process which should be of particular interest to an inspector:

1. There must be no pressure or vacuum changes transmitted to other phases of the HTST unit which will affect the holding time or the pressure relationship of raw to pasteurized product in the milk to milk regenerator.

2. Dilution of milk must not occur.

3. Steam from the boiler which contacts the product must be free from oil, rust particles and other impurities. Impurities enter the steam through carryover of boiler water into the steam lines. Volatile amines used for protecting condensate piping from corrosion should not be used in steam systems connected to this type equipment. Those impurities which are dissolved in the boiler water can be eliminated from the steam by proper operation of the boiler, proper treatment of the boiler feed water, and by effective use of steam purifiers or separators.

Boiler feed water control should be under the supervision of a firm specializing in this service and their recommendations followed. Toxic material should not be used in boiler compounds.

4. Various types of condensers are used, including plate type and direct water or side arm type. With the latter types, precautions must be taken to prevent contamination of the milk with the condensing water.

In conclusion, it might be well to point out that with all the research that has been done on UHT and flavor control, it is the actual commercial installations that are establishing the proof of their ultimate value to the industry. It is conceivable that a new concept of pasteurization and milk treatment has been initiated. Problems will be encountered and solved. Without doubt, a great deal of the credit will go to the local sanitarian or public health inspector.

REFERENCES

1. Dunkley, W. L. Major Flavor Problems of the Milk Supply. Proceeding, Milk Supplies Sect., 50th Annual Convention, Milk Industry Foundation. San Francisco. Oct. 21-23, 1957.

2. Dunkley, W. L. Off Flavors Can Be Prevented. Hoards Dairyman. p 400. Apr. 25, 1955.

3. Dahlberg, A. C. High-Temperature Pasteurization from the Small Operators Viewpoint. Internatl. Assoc. Milk Dealers Bull., **34** (8): 174. 1942.

4. Dahlberg, A. C. Lessons to be Learned from the History of High-Temperature Pasteurization. Mich. Agr. Exp. Sta. Special Bull. 335. 1946.

5. Dahlberg, A. C. The Effect of the Time and Temperature of Pasteurization Upon Some of the Properties and Constituents of Milk. Mich. Agr. Exp. Sta. Special Bull. 335. 1946.

6. Foote, G. E. The Effect of Elevated Temperatures in Processing Dairy Products. So. Dairy Products J., **60** (6): 28-30. 1956.

7. Hunziker, O. F. *Condensed Milk and Milk Powder*. Pub. by the author. LaGrange, Ill. 1946.

8. Quinn, J. D. and Burgwald, L. H. High Short Holding and Low Long Holding. Milk Plant Mo., **22** (2): 26. 1933.

9. Roahen, D. C. and Mitten, H. L. Milk Flavor Uniformity is Possible. J. Dairy Sci., **34**: 1328-1332. 1956.

10. Roberts, W. M. Removing Feed Flavors in the Plant. Proceedings, Lab. Sect., 49th Annual Convention, Milk Industry Foundation, Atlantic City, Oct. 31, Nov. 1-2, 1956.

11. Stribley, R. C. Experiences with HTST Heating of High Solids Milk and Milk Products. Proceedings, 5th Annual Nat. Dairy Eng. Conf., Mich. State Uni., Feb., 1957.

12. Tobias, J. Will No-Hold Pasteurization Come Next? J. Dairy Sci., **38**: 325-328. 1955.

Special Service Article

SIMPLIFIED BACTERIOLOGICAL SCREENING PROCEDURES*

Editors Note: This article is of special interest to our readers since it discusses the use of several innovations in bacteriological procedures which differ from the standard agar plate method, so commonly used. Further, it illustrates the fact that the Association's Committee* on applied Laboratory Methods is alert to new developments and wishes to keep our membership informed.

While the agar plate method has long been the standard procedure used in dairy and food bacteriology, other methods involving the use of both solid and liquid media are playing an increasingly important role. The Astell Roll Tube technic, the Bacto-Strip method, and the Millipore Filter procedure are being studied by the Applied Laboratory Methods Committee to determine their applicability in the dairy and food laboratory.

ASTELL ROLL TUBE TECHNIC

The Astell Roll Tube technic has been used extensively in European countries but is still somewhat of a curiosity in the United States and Canada. The advantages of the roll tube method have long been known. As far back as 1922, Professor G. S. Wilson strongly urged the adoption of the procedure. Prouty and Bendixen, in 1944, further emphasized the advantages of this procedure. Its widespread use, however, was hindered by the lack of proper equipment. The Astell equipment first appeared on the market in 1949. It has been subject to several improvements in subsequent years. The apparatus, as it is used today, consists of Roll Tube bottles, bacteriological seals or stoppers, spinner, water bath, and a colony illuminator and counter. The Roll Tube bottles have an overall measurement of 25x75 mm., with an effective inside surface area approximately half that of a standard Petri dish. The bottles have a centralized depression in the base. The bacteriological seals or stoppers are specially designed to vent automatically when the bottles are heated and provide an airtight seal when pressed down. The electrically operated spinner has seven positions, any one or all of which may be used at one time. A multi-jet cooling device is an integral part of the spinner and causes rapid setting of the agar medium in an even film after spinning for a minute or less. Bottles may be inserted on, or removed from, the spinner while it is in motion. The colony illuminator gives indirect shielded light and provides clear illumination of the colonies.

The actual technic consists in inoculating 0.5 ml. of the liquid to be tested (or a dilution thereof) into the bottle containing 4.5 ml. of melted and cooled sterile agar and then placing the inoculated bottle on the spinner. Spinning is continued until the agar has solidified in an exceedingly thin film on the surface. The neck and bottom of the bottle are designed to eliminate any slipping of the agar film. Inoculated bottles are then incubated for 48 hours in an uprgiht position and the resultant colonies counted on the colony illuminator.

The Roll Tube equipment has been in use in this laboratory for nearly two years. Extended experiments have been carried out to compare results using

*Summary of a special report by the Committee on Applied Laboratory Methods, presented at the 45th annual meeting of the International Association of Milk and Food Sanitarians, New York City, September 1958.

TABLE 1. TYPICAL RESULTS SHOWING PERCENTAGE DIFFERENCE BETWEEN TOTAL COLONY COUNTS ON MILK USING THE ROLL TUBE AND THE PETRI PLATE METHOD**

Experiment 1 Laboratory Pasteurized Samples Total Samples—35		Experiment 2 Commercially Pasteurized Samples Total Samples—35	
No. of samples	Percentage difference	No. of samples	Percentage difference
4	0	3	0
10	1 - 10	12	1- 10
13	11- 25	16	11- 25
3	26- 50	4	26- 50
3	51-100		
2	over 100		

**This Table presents a summary of percentage difference, either plus or minus, between total counts using these two methods. The standard agar plate count was taken as 100 percent. Incubation time was for 48 hours at 35 degrees C.

the Petri dish method and the Roll Tube procedure. Results of some of these tests are given in Table 1.

ADVANTAGES OF THE ROLL TUBE

There are many advantages in using the Roll Tube equipment. Roll Tube bottles are much cheaper than Petri dishes and are much sturdier. Media flasks and test tubes are not needed because the agar is placed directly into the bottles before sterilization. Considerable time is saved by not having to wash and sterilize Petri dishes. There is a considerable saving of space in the incubator and autoclave. There is, also, a saving of about 60% in the cost of media because only 4.5 ml. is used in each bottle as opposed to 10-15 ml. in the standard Petri dish. The saving in glassware is about 70% and in labor about 50%. The initial cost of the equipment, exclusive of a tempering water bath, standard in most laboratories, is about $400.00. The equipment is distributed in the United States through the A.P.V. Company Inc., 137 Arthur Street, Buffalo, N. Y.

BACTO-STRIP METHOD

The Bacto-Strip process which was developed by F. J. Forg in 1955, is rather widely used in the food, dairy and drug industries in European countries. The proponents of the procedure do not claim that it is a substitute for any of the officially recognized procedures. They do claim, however, and with justification, that it is a simple and rapid *screening* test, adaptable particularly to the plant that does not have the facilities of a completely equipped laboratory available. The basic principle of this process is the use of a dry paper strip which has been impregnated with a specific medium, sterilized, and stored singly in a sterile plastic envelope. The strips have a distinct absorption capacity varying with the strip being used. The dry medium in the strip dissolves when the strip is dipped into the liquid to be tested an becomes available to the bacteria which are fixed by the swelling of the fibers in the paper. The method can be used anywhere to replace pipettes, flasks of media, and Petri dishes. The taking of samples is greatly simplified. The saving in time and labor is considerable.

Several different types of strips are available. Violet red bile strips are used in determining the presence of coliforms in dairy products after an incubation period of 12-15 hours. Surface contact strips are available for use in determining total counts as well as yeast and mold counts on equipment. These are moist strips carrying an agar medium on both sides and are covered with two plastic sheets. When the strip is taken out of the envelope the first plastic sheet is removed. Then the agar surface of the strip is pressed on the surface being checked. The second sheet, which becomes contaminated when pressed with the finger, is torn off before the strip is to be replaced in its envelope. Special strips have been developed for testing viscous non-acid products. The tear-off portion of the strip has a plastic cuff that is pushed down over the dipped wet strip to remove the viscous surplus material. Special strips are available also for the detection of heat-resistant spore formers; this is particularly applicable to the canning industry.

PRECAUTIONS WITH BACTO-STRIP

Several precautions must be taken when using the Bacto-Strip procedure or results will prove unreliable. Strips must be carefully protected from exposure to light until used (not necessary for the violet red bile strips). If the white strips are exposed before use, they become pale pink in color and are useless. Once the strip has been soaked in the medium being tested and reinserted in the plastic envelope, it must be firmly pressed against the inner side of the plastic before resealing. Failure to do this may result in the appearance of indistinct colonies which are very difficult to count. Hermetically sealed envelopes are essential in order to avoid the loss of moisture necessary for the optimum growth of the bacteria. Proper sealing may be done by placing the open end of the plastic envelope between two glass slides or metal strips and running them rapidly through a flame.

This laboratory has experimented extensively with the Bacto-Strip in the detection of coliform organisms in dairy products. Two hundred and fifty-eight samples of bottled pasteurized products, using the standard violet red bile agar plate and the Bacto-Strip impregnated with the violet red bile medium have been examined. Both the plates and the strips

were incubated at 35°C.; the plates for 24 hours and the strips for 14 hours.

Since various milk products from various processors were examined, it was necessary to arrive at some predetermined conclusion as to what method would be used to determine comparative results. It was decided, therefore, that if the lower count observed (by either method) was 90% or more of the higher count, then the two methods would be considered to give equivalent results. If the lower count, on the other hand, was less than 90% of the higher count, then the method giving the higher count was considered to be significantly better. In other words, there was considered to be no difference between the methods unless the lower one was less than the higher by more than 10% of the higher count.

Of the 258 samples examined, 59 showed the violet red bile agar count to be significantly higher, while 36 showed the Bacto-Strip count to be significantly higher. Thirty-six samples gave negative results by both methods, while the remaining 127 samples showed equivalent results.

The above mentioned results would tend to indicate that the Bacto-Strip process has a definite place in the dairy and food plant, particularly as a rapid screening test. The paper strips, protected from light, can be carried in the sanitarian's pocket and can be used to conduct on the spot tests in the plant.

The only laboratory equipment that is required, or rather recommended, is a suitable water bath or incubator for incubating the inoculated strips. This procedure is very adaptable for *line sampling* when an attempt is being made to pinpoint trouble spots.

Bacto-Strips are manufactured only by the Bacto-Strip AG Co., Zurich, Switzerland. Quali-Trol Associates, Inc., 215 Walworth Avenue, Delevan, Wisconsin, are the exclusive distributors in the United States and Canada.

MILLIPORE FILTER PROCEDURE

The Millipore Filter Technic is not new. It has been in use in this country for the examination of water supplies since shortly after World War II, and in Germany and Russia for many years before that. Only recently, however, has it been applied to the examination of dairy products. The Standard Methods Committee, during 1957 and 1958 has sponsored a study on the use of the Millipore Filter method in determining coliform and total plate counts on dairy products. The results of the two surveys have been inconclusive but they do point up the availability of a new diagnostic tool. The terminology used when referring to this technic varies in as much as it is known as the *Membrane Filter*, the *Molecular Filter*, the *Molecular Filter Membrane*, or the *Millipore Filter* (MF). The latter name is the one used by the Millipore Filter Corporatoin of Watertown, Massachusetts, which manufactures and distributes the complete apparatus.

The membrane itself is a small (47 mm. in diameter) circular, paper-thin disc containing many millions of fine pore openings. The membrane will filter out and collect on its surface all the bacteria suspended in a liquid forced through it. After the bacteria are collected, the membrane is aseptically removed from the filter base and transferred to an absorbent pad which has been treated with a small amount of a specific type of broth, depending upon the examination that is being carried out. The membrane and pad are then incubated at 35°C., in a humid atmosphere for 20 hours, after which the colonies are counted. Most of the media used have one or more indicators added so that it will be easy to differentiate the colonies on the colorless membrane.

COLIFORM DETERMINATIONS

This laboratory participated in the studies mentioned above during both years. In conducting the coliform studies it was found necessary to use Type DA white grid membranes, with a pore size of 0.65 microns. It was found necessary, also, to mix the milk sample with 50 ml. of a 0.1% solution of Triton X-100 previously heated to 48°C., to facilitate filtration. A 5.0 ml. milk sample was filtered. Immediately after filtration, the membrane was removed aseptically from the filter base and placed on a pad which had been saturated with MF-Endo broth solution in a disposable plastic Petri dish. Membranes and dishes were inverted and incubated at 35°C., for 20 hours. After incubation, filters were removed from the Petri dishes with forceps and placed on absorbent pads to dry for at least ten minutes. Dried membranes were examined under a binocular dissecting microscope. Colonies showing a golden metallic sheen were reported as coliform colonies.

Standard violet red bile agar was used in preparing the Petri dish cultures, with 1.0 ml. of milk having been inoculated into each dish. These dishes were likewise inverted and incubated at 35°C., for 20 hours. Only those colonies showing a typical brick red coloration and measuring at least 0.5mm. in diameter were reported as coliforms.

Due to the fact that many of the samples tested showed extremely low coliform counts, it was difficult to place any hard and fast determination on the results. Positive samples, however, showed a close correlation between the two tests, with the added fact that 5.0 ml. of milk was tested using the M.F. procedure and only 1.0 ml. using the standard violet red bile agar plate procedure. It would seem, therefore, that the M.F. procedure might have a very prac-

tical application in the dairy plant control of coliforms.

TOTAL COUNT DETERMINATION

In conducting the total count studies, type HA membranes (0.45 micron pore size) instead of the type DA mentioned above to assure that no passage of small organisms would occur. Approximately 10 ml. of sterile distilled water(or buffered) was poured into the filter funnel after which the appropriate volume sample dilution was added. After brief swirling, the mixture was filtered. The membrane was then removed from the filter base and transferred to a sterile pad saturated with M-TGE broth. Petri dishes and membranes were then inverted and incubated in a humid atmosphere at 35°C. for 20 hours. After incubation the Petri dish covers were removed and the membrane flooded with a 0.01% Malachite Green dye solution. The dye remained on the filter for 5 to 6 seconds, after which the excess was poured off. The colonies were then counted and the total count computed.

Plate Count Agar (Difco) was used in preparing the standard plate count cultures, 0.01 ml. and 0.001 ml. dilutions being used. Plates were incubated at 35°C. for 48 hours.

Before attempting to compare the two methods on the basis of total count, it was necessary to arrive at some predetermined conclusion as to what method would be used to determine comparative results. It was decided, therefore, to again use the 20% method; namely, there was considered to be no difference between the methods unless the lower one was less than the higher by more than 20% of the higher count. Forty samples of milk were analyzed by both of the procedures. The standard plate count was significantly higher in 17 samples, the Millipore Filter count was significantly higher in 10 samples, and the remaining 13 samples showed no significant difference. Some of the other cooperating laboratories showed a much greater discrepancy between the standard plate count and the Millipore Filter count. It would seem however, that the Millipore Filter technic might well be considered as a tentative method in the next edition of Standard Methods for the Examination of Dairy Products, thus enabling many more persons in the dairy laboratory field to experiment with it.

CONCLUSION

In this brief paper the author has attempted to bring to the attention of interested persons in the food and dairy industries the availability of three laboratory procedures which have definite possibilities in the diagnostic field, with the hope that they will be used, compared, and reported upon in the near future.

J. C. McCAFFREY, *Chairman*
Chief, Bureau of Sanitary Bacteriology
Illinois Department of Public Health
Chicago, Ill.

REFERENCES

Astell Roll Tube Equipment. Laboratory Practice, **6** #11, Nov. 1957.

Barber, F. W. The Millipore Filter Technique in the Dairy Industry. J. Milk and Food Tech., **17**, 109-112, (1954).

Bush, J. H. A Basic New Tool in Bacteriology. The Scientific Monthly, **75**, 303-305 (1952).

Ceblis, E. and Wegener, K. Testing of the "bacto-strip" process as to the possibilities of its use in bacteriological tests in dairies. Deutsche Molkerei Zeitung, **79**, 237-240 (1958).

Clark, H. F., Geldreich, E. E., Jeter, H. L., and Kabler, P. W. The Membrane Filter in Sanitary Bacteriology. Pub. Health Reports, **66**, 951-977 (1951).

Dickman, A. Membrane Filters in Bacterial Isolation and Cultivation. Nat. Assoc. of Clinical Labs. Bulletin, Oct. 1952.

Editorial. The Role of the Molecular Filter Membrane in the Field of Public Health. Am. J. Pub. Health, **43**, 766-768 (1953).

Forg, F. J. "Bacto-Strip": A Simple Bacteriological Routine Test Method. Laboratory Practice, **5**, #12, Dec. 1956.

Goetz, A. Application of Molecular Filter Membranes to the Analysis of Aerosols. Am. J. Pub. Health, **43**, 150-159, (1953).

Johns, C. K. and Berzins, I. The Bacto-Strip Technique for Making Counts of Bacteria, Molds, and Yeasts. J. Milk and Food Tech., **20**, 345-347 (1957).

Personal Communication. "Bacto-Strip," AG, Zollikon-Zurich, Switzerland.

PROGRAM

FORTY-SIXTH ANNUAL MEETING
INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS, INC.

in joint session with

ROCKY MOUNTAIN ASSOCIATION OF MILK AND FOOD SANITARIANS

and

COLORADO HEALTH OFFICERS ASSOCIATION

Hotel Colorado — **Glenwood Springs, Colorado**

August 26-27-28, 1959

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President: Franklin W. Barber, Oakdale, New York.
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PROGRAM COMMITTEE

William V. Hickey, *Chairman* — Harold J. Barnum
John J. Sheuring — Charles E. Walton
Vincent T. Foley

PUBLICITY COMMITTEE

Thomas L. Jones, Washington, D. C.

TUESDAY — AUGUST 25, 1959

12:00 Noon– 9:00 P.M.–Registration – *Main Lobby*

SPECIAL MEETINGS

9:00 A.M.–10:30 A.M.–Executive Board and Local Arrangements Committee
Presidential Suite Parlor

10:30 A.M.–12:00 Noon–Executive Board and Journal Editors
Presidential Suite Parlor

1:30 P.M.– 5:00 P.M.–Individual Committee Meetings
(See Bulletin Board)

1:30 P.M.– 3:00 P.M.–Executive Board and Committee Chairman
Presidential Suite Parlor

5:30 P.M.– 6:30 P.M.–Rocky Mountain Association Executive Board
(See Bulletin Board)

3:00 P.M. IAMFS Executive Board and Affiliate Council
Red Mountain Room

8:00 P.M.– 9:30 P.M.–Social – Reception
Card Room and Glenwood Room

WEDNESDAY — AUGUST 26, 1959

8:00 A.M.– 5:00 P.M.—Registration
Main Lobby

10:00 A.M.– 5:00 P.M.—Milk Bar*
Near Glenwood Room

***Courtesy of: American Dairy Association of Colorado**

MORNING — GENERAL SESSION

Glenwood Room

CHARLES E. WALTON, *2nd Vice President* IAMFS
President Rocky Mountain Association, Presiding

9:00 A.M.—Invocation — REV. W. O. RICHARDS
Episcopal Church, Glenwood Springs

9:05 A.M.—Address of Welcome — DR. WILLIAM HAYNES, President, Colorado State Health Officers Association
Response — PAUL FREEBAIRN
President-Elect Rocky Mountain Association

9:35 A.M.—Introduction of FRANKLIN W. BARBER, President, I. A. M. F. S., by CHARLES WALTON
Presidential Address — FRANKLIN W. BARBER

10:00 A.M.—Charge to Nominating Committee by PRESIDENT BARBER

10:15 A.M.—"The Sanitarian in Tomorrow's Public Health Program"
DR. JOHN D. PORTERFIELD, Deputy Surgeon General U. S. Public Health Service, Washington, D. C.

10:45 A.M.—Milk Break

10:55 A.M.—Committee Report—"Committee on Communicable Disease Affecting Man"
DR. RAY J. HELVIG, Washington, D. C. *Chairman*

11:05 A.M.—"Staphlococcal Food Poisoning Outbreak Due to Cheddar Cheese"
DR. S. L. HENDRICKS, Iowa State Department of Public Health, Des Moines, Iowa, with W. J. HAUSLER, JR., and R. A. BELKNAP, Collaborating

11:25 A.M.—Committee Report — Education and Professional Development W. HOWARD BROWN, Jacksonville, Florida, *Chairman*

11:35 A.M.—"Sanitation Problems in the New Pressurized Foods" HAROLD WAINESS, HAROLD WAINESS & ASSOCIATES Chicago, Illinois

12:00 NOON—Luncheon — Buffet Service — *Patio*

AFTERNOON — MILK SESSION

JOHN J. SHEURING, *1st Vice President IAMFS*, Presiding

1:10 P.M.—Door Prizes

1:15 P.M.—Committee Report — Committee on Farm Practices

DR. ROBERT W. METZGER, *Chairman*
Syracuse, New York

1:25 P.M.—"Q Fever Test Results on all Raw Milk and Cream Produced in Wyoming"

MIKE PURKO, State Chemist, Wyoming Department of Agriculture, Laramie, Wyoming

1:35 P.M.—Panel Discussion — "3A Sanitary Standards Committee" Theme: What are they? How do they work? What are the results? Moderator, DR. E. H. PARFITT, *Executive Director*, Evaporated Milk Institute, Chicago, Illinois

1. "How the 3A Sanitary Standards Committees Develop the Standards"
   DON WILLIAMS, Technical Director DISA, Washington, D. C.
2. "The Value of 3A Standards from a Fabricators Viewpoint"
   GEORGE PUTNAM, Creamery Package Manufacturing Company, Chicago, Illinois
3. "The Value of 3A Standards from the Users Viewpoint"
   (To be announced)
4. "The Role of the Sanitary Procedures Committee in the Development of 3A Standards"
   C. A. ABELE, The Diversey Corporation, Chicago, Illinois
5. "The Role of the U. S. Public Health Service in the Development of 3A Standards"
   JOHN D. FAULKNER, Chief, Milk and Food Program, USPHS Washington, D. C.

2:50 P.M.—Milk Break

3:00 P.M.—"Modern Milk Sanitation Problems," A Symposium DR. C. K. JOHNS, Moderator, Canada Dept. of Agriculture
Ottawa, Canada

1. Value of Coliform, Psychrophylic and "Thermoduric Organism Detection in Poor Producer Sanitation"

   WILLIAM R. GODFREY, Director of Quality Control Hi-Land Dairy, Murray, Utah

2. "Changing Needs in the Bacteriological Examination of Raw Milk"

   JAMES MEANY, Chicago Board of Health, Chicago, Illinois

3. "Methods and Problems of Milk Conveying Systems from Barn to Milkhouse, including Plastic Pipe Lines"

   IVAN PARKIN, Extension Dairyman, Pennsylvania State University, State College, Pennsylvania

4. "Bulk Tank Sediment Testing"

   ELMER KIHLSTRUM, Johnson & Johnson, Chicago, Illinois

4:15 P.M.—Committee Report — "Ordinances and Regulations Pertaining to Milk and Dairy Products"

DON RACE, Dairy Products Improvement Institute, Inc., Ithaca, New York

4:25 P.M.—Committee Report — "Committee on Sanitary Procedures"
C. A. ABELE, *Chairman*

AFTERNOON — FOOD SESSION

Palomino Room

VINCENT T. FOLEY, *Secretary-Treasurer, IAMFS*
Presiding

1:10 P.M.—Door Prizes

1:15 P.M.—Committee Report — Food Equipment Sanitary Standards

JOHN FRITZ, Washington, D. C. District Health Department

1:25 P.M.—"Pre-Cooked Frozen Foods" — CARROLL BRINSFIELD, Maryland Department of Health, Baltimore, Maryland

1:55 P.M.—Committee Report — "Frozen Food Sanitation"

FRANK FISHER, Indiana State Board of Health, Indianapolis

2:05 P.M.—"Contributions of Milk and Food Research to Public Health"

KEITH H. LEWIS, Taft Sanitary Engineering Center, Cincinnati, Ohio

2:35 P.M.—Milk Break

2:45 P.M.—Committee Report — Baking Industry Equipment Standards

SOL ABRAHAMSON, New York City Department of Health

2:55 P.M.—"Is Your Food Sanitation Program Working"

H. S. ADAMS, Director, Sanitary Science Courses Indiana University Dept. of Public Health, Indianapolis, Indiana

3:35 P.M.—Development and Application of a Food Sanitation Program

JACK H. WHITMAN, San Diego Department of Public Health, San Diego, California

4:00 P.M.—Cleanibility of Surfaces
T. L. Hays, American Can Company, Maywood, Illinois

4:30 P.M.—Rocky Mountain Association Business Session and Election of Officers

6:30 P.M.—Barbeque — *Patio*

THURSDAY — AUGUST 27, 1959

MORNING — GENERAL SESSION

Glenwood Room

WILLIAM V. HICKEY, *President-Elect IAMFS* — Presiding

8:45 A.M.—Door Prizes

8:55 A.M.—Movie — "My Milk Man Joe" — Denver Dairy Council

9:15 A.M.—"Present Problems in High Heat Pasteurization Processes"

HAROLD B. ROBINSON, Chief, Milk Section, U. S. P. H. S., Washington, D. C.

9:45 A.M.—Committee Report — Committee on Membership

HAROLD WAINESS, *Chairman*

9:55 A.M.—"Studies on the Use of Sewage Effluent for the Irrigation of Truck Crops" — DR. STUART G. DUNLOP, Associate Professor of Microbiology, University of Colorado Medical Center, Denver, Colorado

10:25 A.M.—Committee Report — Committee on Research Needs and Applications

DR. S. H. HOPPER, Indiana University — *Chairman*

10:35 A.M.—Milk Break

10:45 A.M.—"The Problem of Non-uniformity in Labeling of Dairy Products"
Panel Discussion — Moderator: DONALD RACE, Dairy Products Improvement Institute, Ithaca, New York

MIKE PURKO, Wyoming Dept. of Agriculture, Laramie, Wyoming

GEORGE SHADWICK, Beatrice Foods Company, Chicago, Illinois

R. D. KUMMEL, Carnation Company, Los Angeles, California

HAROLD J. BARNUM, Denver Dept. of Health and Hospitals, Denver, Colorado

11:20 A.M.—Committee Report — "Committee on Applied Laboratory Methods"

J. C. MCCAFFREY, Illinois Department of Health, *Chairman*

11:30 A.M.—"Bactericidal Inhibitors in Rubber and Rubber-like Materials"

DR. JAMES C. WHITE, Professor of Dairy Industry, Cornell University, Ithaca, New York

11:55 A.M.—Report on Activities of the "Sanitarians Joint Council"

H. S. ADAMS—*Past Chairman*

AFTERNOON — FIELD TRIPS

7:00 P.M.—Annual Awards Banquet —

Colorado Room

DR. FRANKLIN W. BARBER, *President* I. A. M. F. S. Presiding

Presentation of Citation Award and of Sanitarians* Award I. A. M. F. S. — PAUL CORASH, Chairman of the Committee on Recognition and Awards —

Entertainment

*The Sanitarians Award is sponsored jointly by the Diversey Corporation, Klenzade Products, Inc., Oakite Products, Inc., Olin Mathieson Chemical Corporation and Pennsalt Chemical Corporation and is administered by the International Association of Milk and Food Sanitarians, Inc.

FRIDAY — AUGUST 28, 1959

Glenwood Room

DR. FRANKLIN W. BARBER, *President I. A. M. F. S.* — Presiding

8:45 A.M.—Door Prizes

9:00 A.M.—Panel Discussion — Reorientation of the Sanitarian into the Whole Public Health Program: Health Officers and a Sanitarian.

Moderator: DR. JOHN PORTERFIELD, U. S. P. H. S.

DR. WILLIAM HAYNES, Tri-County Health Department, Aurora, Colorado—The Local Health Officer

DR. RICHARD REECE, Colorado State Health Department, Director Local Health Services

DR. CECIL REINSTEIN, Director Preventive Medicine, Wyoming State Health Department, Cheyenne, Wyoming

CAMERON ADAMS, Washington State Department of Agriculture
Olympia, Washington

10:00 A.M.—Milk Break

10:10 A.M.—"National Restaurant Association Looks at Food Sanitation"

DONALD GREENAWAY, *Executive Vice President*, National Restaurant Association, Chicago, Illinois

10:45 A.M.—Business Meeting—Election of Officers
Executive Secretary's Report
Installation of Officers

12:30 P.M.—Luncheon — Buffet — *Patio*

2:00 P.M.—Executive Board Meeting with New Board and Report from Advisory Committee on Association Activities, Programs and Administrative Practices.

Local Arrangements Committee

**U. S. Public Health Service Trailer with Short Time-High Temperature Unit will be parked near the Hotel for inspection and demonstration.

LOCAL ARRANGEMENTS COMMITTEE

MRS. NEVEN KILPATRICK — JOHN GUINN
MISS LINDY LOU HUBBARD — PAUL FREEBAIRN
CHARLES WALTON — FRED VOGT
S. M. MORRISON — EVERETT MARSDEN
CHARLES DUNLAP — JOSEPH H. MASON, JR.
CHARLES DUBOIS — HAROLD J. BARNUM, *Chairman*

1. Value of Coliform, Psychrophylic and "Thermoduric Organism Detection in Poor Producer Sanitation"

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2. "Changing Needs in the Bacteriological Examination of Raw Milk"

   JAMES MEANY, Chicago Board of Health, Chicago, Illinois

3. "Methods and Problems of Milk Conveying Systems from Barn to Milkhouse, including Plastic Pipe Lines"

   IVAN PARKIN, Extension Dairyman, Pennsylvania State University, State College, Pennsylvania

4. "Bulk Tank Sediment Testing"

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8:45 A.M.—Door Prizes

9:00 A.M.—Panel Discussion — Reorientation of the Sanitarian into the Whole Public Health Program: Health Officers and a Sanitarian.

Moderator: DR. JOHN PORTERFIELD, U. S. P. H. S.

DR. WILLIAM HAYNES, Tri-County Health Department, Aurora, Colorado—The Local Health Officer

DR. RICHARD REECE, Colorado State Health Department, Director Local Health Services

DR. CECIL REINSTEIN, Director Preventive Medicine, Wyoming State Health Department, Cheyenne, Wyoming

CAMERON ADAMS, Washington State Department of Agriculture
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Executive Secretary's Report
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CHARLES DUNLAP — JOSEPH H. MASON, JR.
CHARLES DUBOIS — HAROLD J. BARNUM, *Chairman*

NEWS AND EVENTS

QUESTIONS AND ANSWERS

Note: Questions of technical nature may be submitted to the Editorial Office of the Journal. A question in your mind may be in the minds of many others. Send in your questions and we will attempt to answer them.

Question: **Most insecticide recommendations state that *Methoxychlor* can be used only as a dust for fly control on dairy cows. Why is it not permissible to spray liquid Methoxychlor; but, permissible to use Methoxychlor as a dust on lactating dairy cows?**

Answer: Methoxychlor used in a liquid spray is actually the insecticide dissolved in an oil which usually has an added chemical to make the solution compatible with water and make dilution easier. When Methoxychlor in this form is sprayed on a cow, it is absorbed into the tissues, ultimately making its way into the milk. This is much the same as the absorption of mineral oil applied to the human skin. In comparison Methoxychlor as a dust, or wettable powder, is merely a suspension of a finely ground methoxchlor in a suitable inert clay or dilutent. These finely ground particles are not readily soluble, and therefore are not absorbed into the body. Moreover, the clays used in the dust will absorb any moisture or oil present. This action is comparable to talc being applied to the skin.

Question: **When doing routine water samples, is it always necessary to perform the completed test?**

Answer: No, it is not necessary to perform the completed test on routine water samples if it has been established beyond a reasonable doubt that the confirmed test will determine the sanitary quality of the water.

Question: **How long after seeding with B. subtilis culture can whey agar plates be held before being used for antibiotic tests?**

Answer: If the plates are held for more than three days, the growth of the B. subtilis will be erratic and the plates will be difficult or impossible to read.

Question: **How long should milk be kept out of the supply after treatment with antibiotics by the *intra-muscular* method?**

Answer: This would depend upon the massiveness of the dose. Ordinarily, the intra-muscular injection of an antibiotic such as penicillin would not result in this drug being found in the milk. Intra-muscular injections, when used, are given by a veterinarian when an animal is acutely sick and feverish. Under such circumstances, the milk of the animal should be discarded anyway. Difficulty with antibiotics in milk does not come via the intra-muscular route; rather it is through the indiscriminate use of udder infusion and failure to discard the milk for at least six milkings.

GOSLEE HONORED BY CONNECTICUT ASS'N.

The Connecticut Association of Dairy and Food Sanitarians honored Clif Goslee at their May meeting, when he was presented a Life Membership Certificate in recognition of his thirty years of service as Association Secretary. Shown is President Stephen Mizak, (right) presenting the Certificate to Mr. Goslee upon his retirement as Secretary.

FEDERAL LEGISLATION ON COLOR ASKED

The U. S. Department of Health, Education, and Welfare, has submitted a proposed bill to the 86th Congress to establish a new plan of regulation to insure safe use of color additives in foods, drugs, and cosmetics.

The bill would replace the present "coal-tar color" provision in the Federal food and drug law enforced by the FDA.

In transmitting the bill to Congress, Secretary Flemming said it was "designed to meet a pressing need for replacing the inconsistent, and in part, outmoded provisions which now govern the use of different kinds of color for articles covered by the Federal Food, Drug, and Cosmetic Act."

He said the proposed law would provide a scientifically sound and uniform system for the testing of color additives of any kind which may safely be

used in foods, drugs, or cosmetics. When necessary the colors would be subject to appropriate tolerances, limitations, and other conditions of use, and to official testing and certification of individual batches of color so as to insure safety of use to the consumer.

"The theory back of the present law," Dr. Flemming said, "is that some coal-tar colors are so safe that any amount may be consumed, for any length of time, without risk. Modern methods of testing on laboratory animals show this is not true. On the other hand, most of these colors are safe when used in proper amounts. The problem is that the present law does not authorize FDA to limit the amount of color which may be used in foods, drugs, or cosmetics. The Government must ban the use of any coal-tar colors if their use, in large quantities, is harmful, even though their use in small quantities may be harmless."

The new bill is designed to expedite the testing of colors to determnie safe levels of use by requiring color manufacturers to do the appropriate research and to submit the results to the FDA. All types of color additives would be subject to the safety requirements of the new law, not merely *coal-tar colors* as at present.

The Secretary pointed out that the safe-for-use principle in regulating the use of colors has already been approved by the present session of Congress in legislation authorizing the Food and Drug Administration to fix a tolerance for Citrus Red No. 2, used to color oranges. This temporary legislation expires September 1, 1961, or earlier if general color legislation is enacted before that time.

SANITARIAN'S REGISTRATION ACT PASSED IN STATE OF WASHINGTON

The 1959 Washington State legislature passed a Sanitarian's Registration Act. According to an account in the Quarterly Bulletin of the Washington Milk Sanitarian's Association, "Progress is being made to implement the provisions of the Act with particular immediate emphasis on the appointment of an examing board. Most sanitarians feel that although this Act may not be the ultimate, it is certainly a step in the right direction of having qualified personnel in the various sanitarian positions."

(NOTE—There are now sixteen states with sanitation registration acts).

MARKET FOR COTTAGE CHEESE STUDIED

Americans of all ages have increased their cottage cheese consumption nearly 80 percent in the past 10 years. People in some parts of the country, however, eat larger quantities of cottage cheese than others. For instance, four or five times more cottage cheese is consumed per person in the Midwest than in the South.

According to a recent U. S. Department of Agriculture study, only 22 percent of the urban families in the South use cottage cheese. This is well below the 39 percent average for the Nation as a whole. It is also below the average consumption of the other regions of the country. In the Northeast, 34 percent of the families buy cottage cheese, while in the West and North Central areas, 52 percent purchase it. Or, to put it a little differently, urban families in the North Central area buy nearly 3½ times more cottage cheese than their Southern neighbors.

Since the big area of possible expansion of cottage cheese sales obviously lies in the South, Agricultural Marketing Service' analysts centered their attention on several Southern markets. Atlanta, Ga., was one of these.

According to the Atlanta Consumer Panel, which is operated by the Georgia Agricultural Experiment Station, income and racial groups here varied considerably in their purchases of cottage cheese. Evidently, cottage cheese was considered a luxury item rather than the economical protein supplement which it is. Of those Atlanta families who purchased cottage cheese, 60 percent of them had incomes over $4,000 a year, but only 37 percent of the city's population fell in this income category. On the other hand, 12 percent of the families purchasing cottage cheese were in the lowest income bracket — below $2,000 a year.

Race also proved an important factor in cottage cheese consumption. Although 62 percent of the families in Atlanta are white, 81 percent of the families buying cottage cheese were white. The percentage of all Atlanta families buying cottage cheese in any week during the study ranged from 6 to 15 percent. This suggests a promising area for increased promotional activities to attract new buyers.

A pre-Easter promotional campaign of 6 weeks in 4 Southeastern markets proved that new buyers can be stimulated through advertising. Many of those who purchased cottage cheese during the promotional period continued to use it afterwards. Cottage cheese sales rose in some areas as high as 60 percent during ped off later, but usually they remained above their the promotional period. These sales, of course, drop-original levels.

Families who buy and serve cottage cheese get not only a tasty food treat, but a healthful one as well. About 12 ounces of cottage cheese supplies all of the daily protein needs of an adult. It also contains a high percentage of riboflavin and calcium, the two nutrients most likely to be lacking in the average diet.

Winners of the fifth annual Samuel J. Crumbine National Award receives plaques and medallions from Dr. Berwyn Mattison, Executive Director of the American Public Health Association. Shown above, left to right, are: Dr. Sidney B. Clark, San Diego County's Assistant Director of Public Health; Mr. Wilbur C. Parkinson, Chief Sanitarian, Salt Lake City Health Department. Seated, Dr. Berwyn Mattison, Executive Director of the American Public Health Association; Dr. Richard J. Nelson, Salt Lake City Health Commissioner; Director Larry J. Gordon, Albuquerque, New Mexico Health Department.

SALT LAKE CITY AND SAN DIEGO HEALTH DEPARTMENT RECEIVES NATIONAL AWARD

Salt Lake City and San Diego received highest awards for sanitation programs conducted by their health departments in a 1959 competition open to more than 1,200 local health departments throughout the country. Presentations were made at the annual meeting of the Western Branch of the American Public Health Association, at the Sheraton-Palace Hotel by Dr. Berwyn Mattison, executive director of the American Public Health Association.

In the competition, sponsored by the Public Health Committee of the Paper Cup and Container Institute, the Salt Lake City (Utah) Health Department was judged first for "outstanding achievement in the development of a program for environmental sanitation" and the San Diego (Calif.) County Health Department was judged first for "outstanding achievement in the development of a program for eating and drinking sanitation."

At the meeting, Dr. Mattison presented plaques to Dr. Richard J. Nelson, Salt Lake City's Health Commissioner, and Dr. Sidney B. Clark, San Diego County's Assistant Director of Public Health, for the achievement of their departments. For their personal leadership in the winning programs, bronze medallions were awarded to Dr. Nelson, Dr. J. B. Askew, San Diego's Director of Public Health, Wilbur C. Parkinson, Salt Lake City's Director of Environmental Sanitation, and William B. Walshe, Chief of San Diego's Division of Sanitation.

In accordance with the recommendations of the Jury, a special certificate of merit was awarded to the Albuquerque (N.M.) Health Department for the ex-

cellence of its programs in both divisions of the contest – environmental sanitation, and eating and drinking sanitation. Larry J. Gordon, the Department's Director, was present to receive it from Dr. Mattison.

Dr. Mattison also reported that the Jury had recommended that letters of commendation be sent to the Alameda County (Calif.) Health Department and the Nashville-Davidson County (Tenn.) Health Department for the excellence of their programs of environmental sanitation.

THE SALT LAKE CITY PROGRAM

Salt Lake City's program drew special attention this year for the emphasis it placed on working with all available citizen groups in developing and carrying on its comprehensive program for environmental sanitation.

A special feature of its in-service training program for staff personnel is its stress on public relations, interviewing and counselling. Experts on these subjects are brought in from industry and the State Board of Health to take part in the training program.

During the past year the Department secured the adoption of new ordinances for the licensing of vending machines, the inspection of children's care centers, the control of housing, the regulation of swimming pools, the control of miscellaneous food establishments, and the regulation of poultry sanitation.

The watershed ordinance was revised to set new standards for the disposal of wastes in the area, and a cooperative program for improvement of the water supply was put into service. Control of nursing homes was intensified, and employees in these places were given educational courses to improve their performance. All of these measures have resulted in marked improvement in the various areas affected.

SAN DIEGO'S PROGRAM

This is the second Crumbine Award for San Diego, which in 1957 won top honors for environmental sanitation.

In its deliberations, the jury of health authorities was impressed with the thoroughness with which the San Diego eating and drinking establishment sanitation program was planned and executed. Among the features of the program which attracted favorable comment were:

All new sanitarians receive five weeks of in-service training before being assigned to regular duties. At intervals, further in-service training courses are held for staff members to maintain uniformity in grading restaurants and to keep personnel up to date.

All regulations governing the industry are developed in collaboration with those affected.

All operators of public eating places are encouraged to adopt self-inspection procedures.

The Department regularly uses television, radio and newspapers to keep the public informed about its program and objectives. It also provides speakers at service clubs to secure support for its efforts.

Periodically the Department requests the State Health Department to make a survey of its eating and drinking places to obtain an objective evaluation of the local progress being made.

An indication of the success of the program is the fact that in February, 1959 of the 1,915 restaurants in the county, 1,841 held "A" cards.

Most recent development in the Department's sanitation activities is a regulatory program covering food service operations on sport fishing vessels in cooperation with the boat owners.

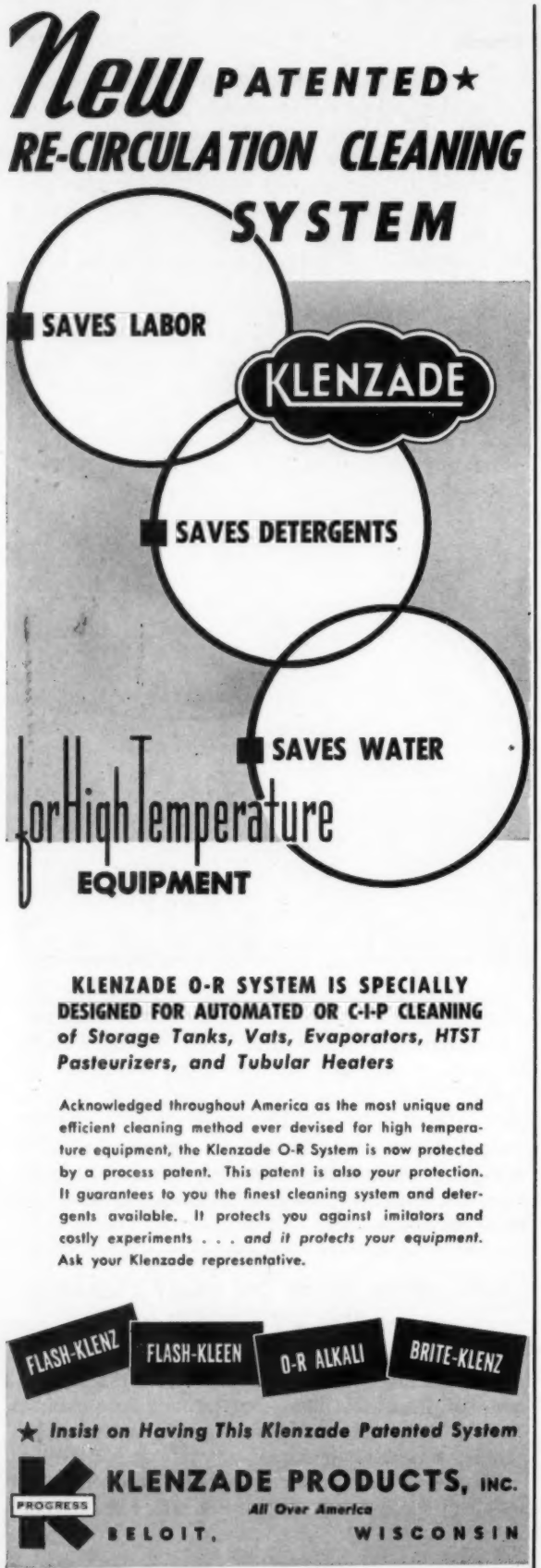
INDONESIAN STUDENT VISITORS

International's headquarters were visited recently by three Indonesian students from Djakarta, Indonesia. The operation of the Association was explained to them by Red Thomasson. Each was given a copy of a recent edition of the Journal. From left to right: Burhanuddin Murbarad, Wasito Martoardjono, Executive Secretary Red Thomasson, and Soebeno Hadiwidjojo.

NEW COLOR MOVIE ON DAIRY CLEANING AND SANITATION

A new full-color motion picture on dairy cleaning and sanitation has been produced by the B-K Department of Pennsalt Chemicals Corporation. Entitled "Key to Dairy Sanitation," the film is 16mm and has running time of 25 minutes.

The new picture presents modern cleaning and sanitation procedures for dairy farm milk handling and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for High Temperature EQUIPMENT
KLENZADE O-R SYSTEM IS SPECIALLY DESIGNED FOR AUTOMATED OR C-I-P CLEANING
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Acknowledged throughout America as the most unique and efficient cleaning method ever devised for high temperature equipment, the Klenzade O-R System is now protected by a process patent. This patent is also your protection. It guarantees to you the finest cleaning system and detergents available. It protects you against imitators and costly experiments . . . and it protects your equipment. Ask your Klenzade representative.
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All Over America
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storage of utensils and equipment, milk tank trucks, and the variety of equipment used in dairy plant operations. Starting with the milk cow and following the movement of milk from milking through farm storage, transportation, and processing, the film shows graphically how the latest types of chlorinated cleaners, acid-type sanitizers, cleaner-sanitizers as well as well-established manual cleaners and chlorine sanitizers should be used for high quality milk.

The new movie was filmed in California, Iowa, and Pennsylvania by Golden State Productions to provide coverage of large and small dairy farm and plant operations. The colorful pictorial story as well as the accompanying sound track refer to variations in sanitation requirements in different states so that the picture serves as an excellent educational medium in all states.

The film is available free for showings to schools, farm groups, dairies, dairy supply distributors, and community organizations. Because of the heavy initial demand, Pennsalt requests that orders for the film be submitted well in advance of scheduled showing dates. Requests for the motion picture should be addressed to the B-K Department, Pennsalt Chemicals Corp., 3 Penn Center, Philadelphia 2, Pa.

CIGARETTE SMOKING AND LUNG CANCER*

The increasing frequency of lung cancer is of great public concern. Lung cancer caused 2,626 deaths in California during 1957, and the number will be even greater for 1958 when the figures are all compiled. The lung cancer death rate per 100,000 for California men has increased from 11.2 in 1940 to 21.9 in 1950, and to 33.4 in 1957. Cancer of the lung is now the leading cause of cancer deaths among men in California. The death rate from lung cancer also has increased somewhat for women. The California experience is paralleled throughout the Nation and in a number of other countries.

Because of the present and growing importance of this disease and because of divergence in views expressed as to its causation, the California State Department of Public Health is obligated to evaluate the present evidence and interpret it for the public. The major question here is the role of cigarette smoking in the causation of lung cancer. Whereas the national health authorities of the United States, Great Britain, and other countries have stated that much scientific data indicate cigarette smoking to be a causative factor in this disease, spokesmen for the tobacco industry continue to deny that the evidence is conclusive.

For the last 10 years the California State Department of Public Health has been studying the possible causes of lung cancer with attention not only to cig-

*Reprinted from, *California's Health* Vol. 16:22, *June* 1, 1959

arette smoking, but also to occupational factors and air pollution. As early as 1950 our findings indicated a link between cigarette smoking and lung cancer. Since that time, the evidence both from our own research and that of others has become conclusive that cigarette smoking is an important causative factor in lung cancer. It is possible that research now in progress may definitely implicate additional factors. However, the weight of evidence with regard to cigarette smoking as a cause of lung cancer is now so great that the department must bring the matter to the attention of the public.

The Evidence

Several large-scale investigations, such as those of the American Cancer Society and the U. S. Public Health Service which involved the observations of hundreds of thousands of persons, have shown that heavy cigarette smokers have at least 20 times greater chance of suffering lung cancer than nonsmokers. These and other studies show that the heavier the cigarette smoking, the higher rate of lung cancer. It now appears that 1 in 10 heavy cigarette smokers will die of lung cancer — odds approaching those of "Russian roulette." Even light smoking, less than half a pack a day, carries a definite risk for lung cancer.

In addition to the evidence from studies of human population which incriminates cigarette smoking as a cause of lung cancer, a growing body of chemical and experimental animal evidence supports the same conclusion. Cigarette smoke contains chemical substances which have been identified as producing cancer when applied to the skin of animals. A condensation of cigarette smoke applied daily in an amount corresponding to that from a pack of cigarettes produced abnormal skin growths in 20 to 30 percent of the animals tested, and one-third of the growths were cancerous.

In lungs of persons who have died of causes other than cancer, certain cell changes have been found on autopsy which are considered to be early stages in the development of lung cancer. These changes are found much more frequently in the lungs of smokers than in the lungs of non-smokers.

On the basis of such facts carefully reviewed by a special scientific committee, the Surgeon General of the U. S. Public Health Service has stated, "It is clear that there is an increasing and consistent body of evidence that excessive cigarette smoking is one of the causative factors in lung cancer."

A common question about cigarette smoking and lung cancer is — Does it do any good to quit? The answer, according to data from the American Cancer Society study, is YES. Those who had been cigarette smokers and stopped, definitely reduced their risk of

The Only Approved Method of Applying a Sanitary Lubricant to Food Processing Equipment

HAYNES Lubri-Film SPRAY

A SANITARY PLASTIC TYPE SOLID FILM LUBRICANT

FORMULATED FROM U.S.P. LIQUID PETROLATUM AND OTHER APPROVED INGREDIENTS (Laboratory Controlled)

SANITARY • NON-TOXIC ODORLESS • TASTELESS

PHARMACEUTICALLY ACCEPTABLE

CONTAINS NO ANIMAL OR VEGETABLE FATS. ABSOLUTELY NEUTRAL. WILL NOT TURN RANCID — CONTAMINATE OR TAINT WHEN IN CONTACT WITH FOOD PRODUCTS.

PRODUCT AND PROCESS PATENTED U.S. Pat. Nos. 2,627,930 2,628,187 — 2,628,205 2,775,561 — 2,865,466 Other Pat. Pending Also Foreign Patents

Lubri-Film should be used to lubricate

- Separator Bowl Threads
- Pure-Pak Slides & Pistons
- Pump & Freezer Rotary Seals
- Homogenizer Pistons
- Sanitary Plug Valves
- Valves, Pistons & Slides of Ice Cream, Cottage Cheese, Sour Cream and Paper Bottle Fillers, Stainless Steel Threads and Mating S. S. Surfaces
- and for all other Sanitary Machine Parts which are cleaned daily.

Haynes Lubri-Film Sanitary Spray Lubricant is entirely new and different. Designed especially for applications where a heavy duty sanitary lubricant is required.

Lubri-Film is a high polymer lubricant and contains no soap, metals, solid petrolatum, silicones nor toxic additives.

Provides a clinging protective coating for vital metal parts such as slides, bearings and other lubricated surfaces despite moisture.

PACKED 6—16 OZ. CANS PER CARTON.

THE HAYNES MANUFACTURING CO.
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THE ONLY Approved SANITARY METHOD OF APPLYING A U. S. P. LUBRICANT TO DAIRY & FOOD PROCESSING EQUIPMENT

Haynes-Spray

U.S.P. LIQUID PETROLATUM SPRAY

U.S.P. UNITED STATES PHARMACEUTICAL STANDARDS

CONTAINS NO ANIMAL OR VEGETABLE FATS. ABSOLUTELY NEUTRAL. WILL NOT TURN RANCID — CONTAMINATE OR TAINT WHEN IN CONTACT WITH FOOD PRODUCTS.

SANITARY—PURE
ODORLESS—TASTELESS
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This Fine Mist-like HAYNES-SPRAY should be used to lubricate:

SANITARY VALVES
HOMOGENIZER PISTONS — RINGS
SANITARY SEALS & PARTS
CAPPER SLIDES & PARTS
POSITIVE PUMP PARTS
GLASS & PAPER FILLING MACHINE PARTS
and for ALL OTHER SANITARY MACHINE PARTS which are cleaned daily.

The Modern HAYNES-SPRAY Method of Lubrication Conforms with the Milk Ordinance and Code Recommended by the U. S. Public Health Service

The Haynes-Spray eliminates the danger of contamination which is possible by old fashioned lubricating methods. Spreading lubricants by the use of the finger method may entirely destroy previous bactericidal treatment of equipment.

PACKED 6-12 oz. CANS PER CARTON SHIPPING WEIGHT—7 LBS.

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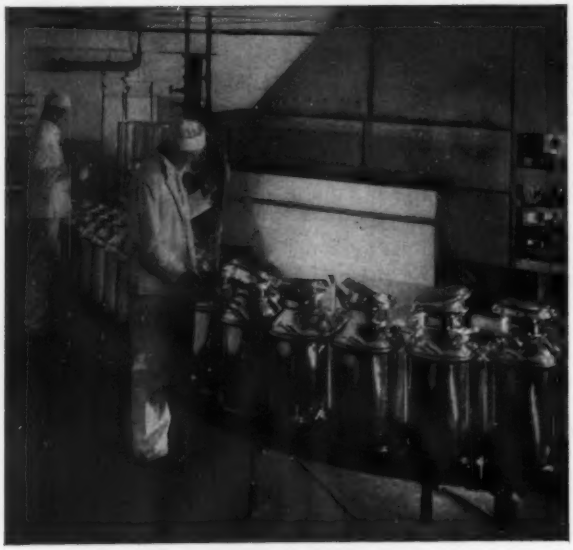

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Everything that contacts milk needs Lo-Bax treatment.

Safe and dry, easy to use, Lo-Bax is the fast, economical chlorine bactericide for sanitizing dairy plant equipment, containers and potential danger spots. To suit your requirements, it comes as Lo-Bax Special and as LoBax-W (with wetting agent).

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dying from lung cancer. Those who had never smoked had the lowest death rate from lung cancer.

Another question concerns the effect of filters. It is possible that they remove some of the offending substances from cigarette smoke. However, they are not known to make cigarette smoking safe. The specific chemical substance in cigarette smoke which is mainly responsible for lung cancer is still not known definitely enough to be confident that it is removed by filters.

N. Y. LAW CHANGED TO PERMIT USE OF SMALL CREAM CUPS

An amendment to the New York State agricultural and marketing law to permit use by dairies of small paper cups for packaging cream has been signed (late April) by Governor Rockefeller.

The law previously had prohibited cream packaging in any containers with a capacity of less than one-half pint. The change authorizes dairies to use one half, three fourths and one ounce cups for prepackaging cream that is sold in tray lots to restaurants and other food establishments.

Many prospective dairy users of the small cups had requested the amendment, according to the Dixie Cup Division of American Can Company. The amendment had been sought for about two years by the New York State Milk Distributors Association, Dixie Cup, state weights and measures officials, health authorities and other groups.

PUBLIC AFFAIRS PROGRAM ADOPTED BY AMERICAN CAN

The American Can Company has undertaken a four-part government relations program to help combat "powerful forces which are seriously undermining our political and economic system," William C. Stolk, president, has declared.

In a call to business leaders to "market" their political viewpoints as forcefully as their products and services, Mr. Stolk warned that "unless we become more sophisticated politically we can look forward to the day when the corporation will become obsolete and government absolute."

He told the 45th mid-year meeting of the Chemical Specialties Manufacturers Association in Chicago, May 20, that the public is being "hoaxed into believing that the nation can consume more than it produces, that our standards of living can be increased by restricting output and reducing hours of work, and that the good life is a life of irresponsibility."

"You and I and other businessmen as corporate leaders," he added, "must give more personal attention to our unique opportunity to exercise the art of

leadership, to fulfill our unique responsibility as managers of human resources. As corporate executives, we have great opportunity to demonstrate and promote sensible ideas and constructive action for the common good. We must, as individuals, personally participate in the job of helping to select, nominate and elect able people to public office."

Mr. Stolk said that the American Can Company, in a determined effort to translate conviction into action, has inaugurated the following program to stimulate activity by the company and its management in the political arena:

1. To inform, equip and encourage everyone in the company's management organization to speak out on the business facts that have a direct bearing on the economic and social well-being of the company, its people and the nation.

2. To make sure that every employee, and his family and neighbors get from the company, both face-to-face and in writing, a continuous flow of facts and viewpoints to round out his understanding and make it possible for him to reach judgments based on all the truth rather than part of it.

3. To give the company's managers the opportunity to study political processes and to learn the art of practical politics. The purpose of this phase of the program is to give managers, and through them, all employees, genuine encouragement to participate personally in politics.

4. To give elected government officials, through the company's management organization the firm's views on important national issues as they come up for consideration in pending legislation.

As part of its action program, Mr. Stolk said, American Can Company has appointed a team of 153 management people across the country to "act as official spokesmen for our company in direct relationship with the 153 representatives and 52 senators who represent states and congressional districts in which the company has facilities. Members of this group have been asked to make themselves known to their legislators, to invite them to our plants and offices and to discuss subjects of mutual interest."

Mr. Stolk added that each of the 153 representatives and 52 senators has been informed in writing of the company's program.

SANITATION ORDINANCE FOR DRY MILK PRODUCTS RELEASED

A recommended sanitation ordinance and code for dry milk products used in Grade A pasteurized milk products has been issued.

This ordinance is known as Supplement I to the Milk Ordinance and Code-1953 Recommendations of the Public Health Service.

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HAYNES SNAP-TITE GASKETS

"FORM-FIT" WIDE FLANGE HUGS STANDARD BEVEL SEAT FITTINGS
MOLDED TO PRECISION STANDARDS
DURABLE GLOSSY SURFACE
DESIGNED TO SNAP INTO FITTINGS

LOW COST...RE-USABLE
LEAK-PREVENTING
NEOPRENE GASKET for Sanitary Fittings

Check these SNAP-TITE Advantages

Tight joints, no leaks, no shrinkage
Sanitary, unaffected by heat or fats
Non-porous, no seams or crevices
Odorless, polished surfaces, easily cleaned
Withstand sterilization
Time-saving, easy to assemble
Self-centering
No sticking to fittings
Eliminate line blocks
Help overcome line vibrations
Long life, use over and over

Available for 1", 1½", 2", 2½" and 3" fittings.
Packed 100 to the box. Order through your dairy supply house.

In the preface of the new document, this statement appears:

"Modern milk drying techniques have made possible the manufacture of high quality dry milk products suitable for use in the commercial preparation of milk products such as reconstituted milk, reconstituted skim milk, cultured buttermilk, flavored reconstituted dairy drinks, special dietary products containing added milk solids, and cottage cheese. In recent years, dry milk products have been utilized increasingly for this purpose, particularly in areas where seasonal or more persistent shortages of market milk occur. The National Conference on Interstate Milk Shipments, recognizing the need for such dry milk products to be of a sanitary quality comparable to that of Grade A market milk, requested the Public Health Service to cooperate with representatives of the Conference and the dry milk industry in drafting sanitary standards for the manufacture of Grade A dry milk products. The service agreed to undertake the development of such standards."

Persons wishing a copy of this publication should send a request to the Public Health Service, Division of Engineering Services, Milk and Food Program, Washington 25, D. C.

TEXAS ASSOCIATION REGISTRATION BILL FAILS TO PASS

The Texas Association of Sanitarians introduced in the 1959 session, a bill for the registration of Sanitarians but, it failed of passage in the Texas House of Representatives.

Commenting on the results, the Texas Association's Secretary-Treasurer, Henry Williams, had this to say:

"We as sanitarians just haven't sold our people on the fact we need such legislation. Only a few of our legislators knew that every state adjoining Texas had such a law. Not enough trade associations, civic groups and influential citizens were contacted and sold on the idea."

Secretary William's comments are significant and should be carefully noted by other associations who may be planning the introduction of sanitarian registration acts. The time to prepare is long before the legislative session starts.

PROFESSOR PAUL H. TRACY TO RETIRE

Professor Paul H. Tracy will retire from the University of Illinois on September 1, 1959. On this date Professor Tracy will have completed 39 years of service with the University. During this period he has had a distinguished career in teaching, in research and particularly in helping and advising those fortunate enough to know him. While September 1 will mark only the close of one career and the start of another for Professor Tracy, it does offer an opportunity to his friends to express their good wishes for his happiness in a new environment.

A small group of his friends and associates are arranging a very informal dinner at the Illini Union on the campus here at 6:30 p. m. C. D. T. July 29 (Wednesday) for Professor Tracy, Mrs. Tracy, and their immediate family.

Classified Ads

FOR SALE

Single service milk sampling tubes. For further information and a catalogue please write Bacti-Kit Co., P. O. Box 101, Eugene, Oregon.

POSITION AVAILABLE

Sanitary Engineer (Public Health)

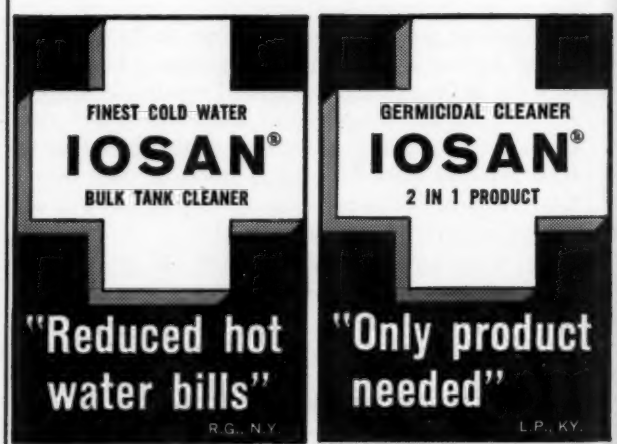
Starting Salary	Maximum Salary
$7627	$9359

City of Rockford, Illinois (population 118,000) For application write:

City of Rockford Civil Service Commission

126 South First Street

Rockford, Illinois



IOSAN cleans and sanitizes Bulk Tanks and other equipment with tap or lukewarm water. Lowers hot water costs. Removes and prevents milkstone buildup. Reduces bacteria counts. Helps prevent mastitis.

IOSAN is the original patented "Tamed Iodine"® Germicidal Cleaner. Used daily by tens of thousands of milk producers. Especially effective for Bulk Tanks. For a free demonstration contact your regular supplier or **Lazarus Laboratories Inc., Div. West Chemical Products Inc., 42-16 West St., Long Island City 1, N. Y.**

IOSAN replaces two or more products. It is a powerful cleaner and sanitizer. Saves time and labor. Lowers bacteria counts. Removes and prevents milkstone buildup. Also helps prevent mastitis.

IOSAN is the original patented "Tamed Iodine"® Germicidal Cleaner. Used daily by tens of thousands of milk producers. Especially effective for Bulk Tanks. For a free demonstration contact your regular supplier or **Lazarus Laboratories Inc., Div. West Chemical Products Inc., 42-16 West St., Long Island City 1, N. Y.**

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RAPID-FLO®

VACULINE®

MILK FILTERS

. . . *engineered* by Johnson & Johnson for in-a-line filters. Available in 4 9/16", 5" and 6" disks; or 2⅜" x 6½" tubes.

Tell your producers with in-a-line filters about new RAPID-FLO VACULINE—*engineered* for safe filtration and clean milk production, plus the extra benefit of a RAPID-FLO® CHECK-UP for mastitis and sediment.

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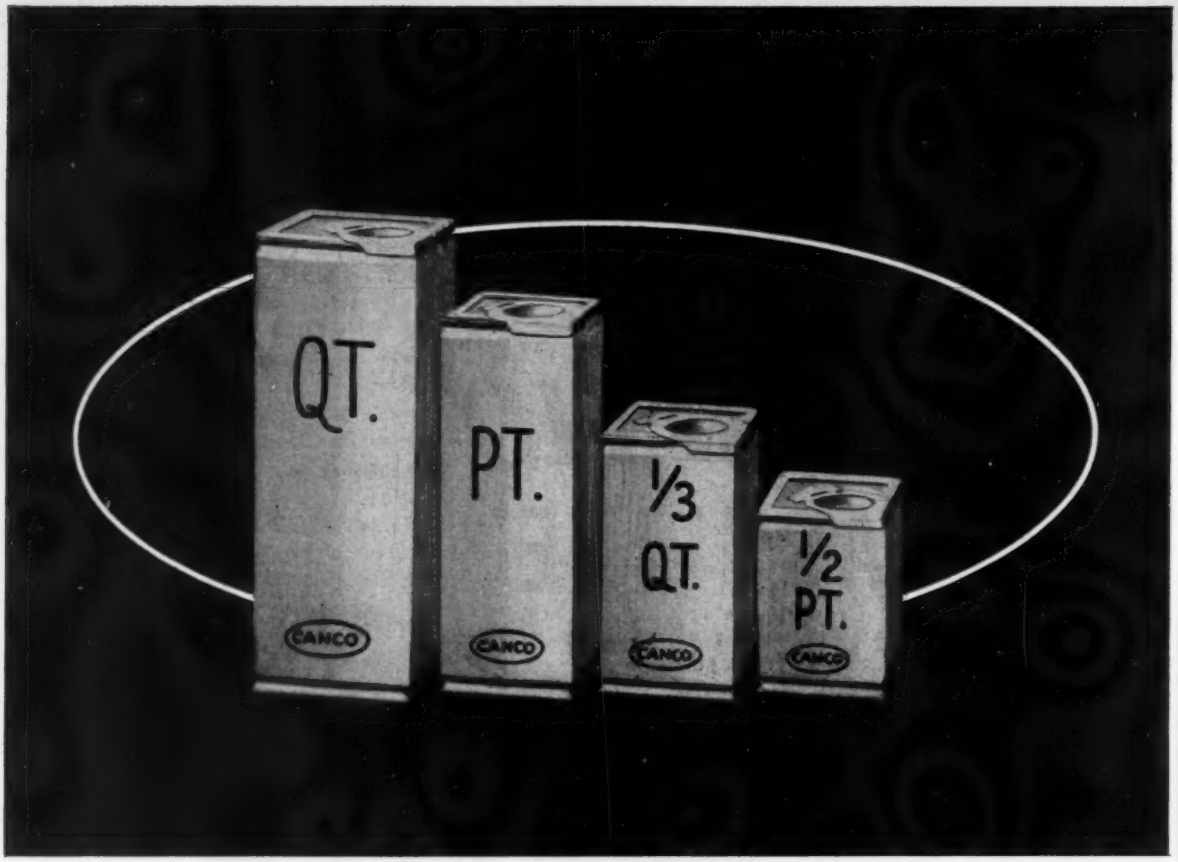

MILK

IN GRADE "A" CARTONS

Canco's paper containers, the original disposable cartons for milk, have been winning greater acceptance every year! Popular with homemakers everywhere, these containers are ideal for use in school cafeterias and vending machines. They are easy to open and close; provide "controlled pouring," and are compact, sturdy, sanitary. Yes, Canco cartons are the *preferred* containers for milk . . . the Grade "A" cartons for nature's most nearly perfect food!

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